This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

SIGILLVM · VNIVERSITATIS · CALIFORNIENSIS
FIAT LVX
MDCCCLXVIII
EX LIBRIS

MASSACHUSETTS
VOL IX

The Massachusetts State Forester- Fourteenth Annual Report. 1917.

The Massachusetts State Forester- Fifteen
Annual Report. 1918.

The Forests of Plymouth County. Mass. Sta
Forester- 1918.

The Utilization of Forests Products in Mas
achusetts as affected by the War.
By Paul D. Kneeland.

Boston Transcript- Plenty of Fuel Wood-
Wednesday, Dec. 26,1917.

Shall the United States Continue to be a
Dumping Ground for Pests? Mass. Stat
Forestry Association. Bulletin 121

Wood Fuel- A Bulletin to stimulate the Pr
duction and use of wood as fuel for
Patriotic and Economic Reasons as a
War Measure.

8 Official Register of Harvard University
Vol. VII No.28. July 16,1910

9 Official Register of Harvard University
Vol.VIII. Graduate School of Applied
Science. Division of Forestry- 1911-

10 Official Register of Harvard University
Vol.XI. No.III. Part 5. School of Forestry. 1914-15

11 Official Register of Harvard University
Vol.XI No.1 Part 30. Graduate School
of Business Administration. 1914-15

12 Supplement to Official Register of Harvar
University. Training for the Lumber
Business.

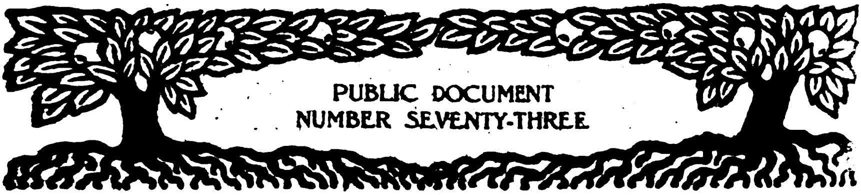
SD144
M3P3
v.9

[illegible]

ASSACHUSETTS
VOL IX

13 Official Register of Harvard University
Vol XIV. No.29 May 29,1917.
Bussey Institution for Research in
Applied Biology.

14 Official Register of Harvard University
Graduate School of Business Administration. 1917-18.



PUBLIC DOCUMENT
NUMBER SEVENTY-THREE

THE MASSACHUSETTS
STATE FORESTER

FRANK W. RANE

FOURTEENTH
ANNUAL REPORT
1917

BOSTON: WRIGHT AND POTTER PRINTING COMPANY, STATE PRINTERS
32 DERNE STREET

Public Document **No. 73**

THE
STATE FORESTER
OF
MASSACHUSETTS.

FOURTEENTH ANNUAL REPORT,
1917.

F. W. RANE, State Forester.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1918.

PUBLICATION OF THIS DOCUMENT
APPROVED BY THE
SUPERVISOR OF ADMINISTRATION.

MAIN LIBRARY

The Commonwealth of Massachusetts.

To the General Court.

In accordance with the provisions of chapter 409, Acts of 1904, the report of the State Forester for 1917 is herewith submitted.

In the stress of war times your State Forester is firmly convinced that we should make it a patriotic duty to try to enforce the fundamental principles of forestry, both in utilizing our present forestry products in the industries, and also in providing if possible for future needs.

With appreciation of the continued co-operation and good will accorded this department in its work, this report is

Respectfully submitted,

F. W. RANE,
State Forester.

[illegible]

CONTENTS.

PAGE
Introduction, 7
Organization, 16
War activities, 19
Sawmill units sent to England, 19
Recruiting for forestry battalions, 20
Furnishing wood to the army, 20
Fuel emergency, 21
Utilization of forest products, 22
Thinning operations, 22
Walpole municipal forest, 23
Reforesting scrub oak or acorn brush lands, 24
Oriental hag moth, 24
Tussock moth, 25
Co-operation with county farm bureaus, 26
General forestry activities, 26
Forest examinations, 27
Reforestation work, 31
Nursery work, 32
Inventory of stock, State nurseries, 1917, 37
State forest administration, 38

Forestry and reforestation work: —

Financial statements, 40
Moving-picture reels, 41
Creosoting gypsy moth egg clusters, 41
Auto-truck sprayers, 42
Moth thinning work, 43
Report of Dr. L. O. Howard on parasite work, 45
Gypsy moths and co-operative cranberry work, 46
Paste *v.* powdered arsenate of lead, 47
Meeting of gypsy moth officials at the State House, 47
Meeting of town officials and moth superintendents at Bourne, 48
Special moth work at Nantucket, 48
Chestnut blight, 49
State Fire Warden's report, 50
Financial statement, 61
Reimbursement for fire equipment, 52
Inventory of fire equipment, 53
Forest fires, 1917, 57
Classified causes of forest fires, 1912–17, 58
Types of land burned over, 59
Classified damages by fires, 59
Comparative damages by fires, 1910–17, 59
Fires reported from observation stations, 1914–17, 60
Precipitation, 1911–17, 61
Railroad fires, 62

	PAGE
Federal co-operation in forest fire expenditure,	64
State highway work,	65
Co-operative moth work,	65
Special funds: —	
Financial statements,	65
Office salaries and incidentals: —	
Financial statements,	66
Distribution of supplies,	67
Gypsy and brown-tail moth suppression: —	
Financial statement,	69
Financial summary of moth work by towns,	72
Meetings and addresses,	87
List of forest wardens,	89
List of local moth superintendents,	89
Remarks,	98

One of the State Forester's new motor truck sprayers in operation on a State highway. The same engine that propels the truck also runs the spray pump. Three of these machines were in use throughout the past season, and easily replaced many horse-drawn sprayers.

A photograph of the State Forester's nursery at the Bridgewater State Farm in Plymouth County. Ten acres have been set aside by Colonel Blackstone for the State Forester's use. With the exception of a foreman the entire work is done by the inmates of the State Farm. The trees shown are Scotch pine transplants, and will be used with white pine in planting throughout the State next spring. There are approximately 1,000,000 trees in this nursery at present.

The Commonwealth of Massachusetts.

FOURTEENTH ANNUAL REPORT OF THE STATE FORESTER.

INTRODUCTION.

Forestry in Massachusetts in the future will be what we of today are far sighted enough to make it.

Massachusetts is a State that is naturally expected to be, and as a matter of fact is, a leader in most worthy undertakings, as her history shows. In forestry work a very creditable showing has already been made. We undoubtedly have the best forest fire protective system of any State. Our reforestation work is well under way, with approximately 15,000 acres set out to young forest trees. The practice of improvement thinnings and modern methods of forest management is yearly receiving more attention by woodland owners. Forest depredations of diseases and insects are given special consideration in regard to their eradication and control in this State. Yet with all our endeavors thus far, hardly more than a beginning has been made in the vast amount to be accomplished.

During the year the activities of the State Forester's Department have been more vigorously prosecuted than ever. Together with the usual work that has been reported upon from year to year, the changed conditions and new duties that have come as a result of the world war have necessarily completely altered many of our plans. While appropriations have been normal in general forestry work and gradually lessening in moth suppression, labor and materials of all kinds have greatly advanced. The department has practiced the strictest economy, and we believe a careful perusal of our activities as shown in this report will give the reader a better appreciation of our work.

In reforestation and nursery work, although labor has been scarce and high, we were able to secure enough of our old foremen and men to round out a most creditable year. While the planting season was interfered with by many rainy days, this weather was very favorable for the young trees, which came through the season in fine shape. The State Forester's nurseries everywhere are in splendid condition. One of the United States government forest officials upon a recent trip to New England highly complimented the department upon its accomplishments. Besides enough trees to use in our reforestation work, this year the State Forester has the sanction of the Governor and Council to distribute to persons who will plant them in Massachusetts not less than 1,000 nor more than 10,000 pine transplants at a fixed price of $7 a thousand, packed for shipment at the nursery. It is believed this offer will tend to increase the interest in forest planting. Send in your orders at once if you wish to be on the list. The trees will be shipped in April. Every one interested in seeing young trees growing in nurseries should take a trip to the State Forester's nursery on the farm of the Massachusetts Agricultural College at Amherst, and to the Barnstable Nursery at Barnstable. A good beginning has been made in a transplant nursery at the State Farm at Bridgewater, where the work is done by the inmates under supervision of one of our foremen. A beginning is also being made in a similar way at the Norfolk State Hospital which it is hoped will grow in importance. Here, again, the work is done by the inmates of the institution.

During the year this department has consulted with the various county agents and schools soliciting their co-operation in forestry work, and it is believed much good will come out of our united action. The county officials are in direct touch with the landowners, and whenever an opportunity is afforded for forestry work this department can back them up with practical assistance, thereby getting something actually done. In the case of the county schools, it is an easy matter to start a small nursery here for demonstration purposes, and if the students have the time to spare, they could be used in April and May on our reforestation work throughout the county, receiving compensation for their services. In these war times labor will necessarily be hard to get; therefore, why not plan on utilizing our young men of public school age in this work? The labor necessary in transplanting small trees is well adapted to the strength of boys of twelve years or over, and the experience gained would give them an interest in forestry in the future. We ask teachers and parents to think this over and take counsel with this department.

During the year the State Forester concluded, after giving much study to the question, to redistrict the moth work. As is shown by a map elsewhere in this report, this work is now organized practically according to counties. As the work is largely confined to the eastern part of the State, all of the western counties are included with Worcester County. All of the division men in charge of moth divisions as at present constituted are provided with automobiles which enable them to cover their territories, keep them in close personal touch with local public officials, and allow them to give necessary supervision for best results. The former division men who are without automobiles will be used on special moth work that may arise in co-operation with the various divisions. This plan will also have a tendency to bring about more uniform results, and allow us to give greater concentration to projects thought worthy of more consideration. The moth work has been raised in efficiency as a whole, and it naturally follows that the local moth superintendents who are experienced, and who have the confidence of the townspeople, do not need such close supervision as in the past. It is desirable as ever to keep the machinery well oiled and in good repair, but when this is in good running order, the time, attention and expense exercised in getting these results may be utilized in other and more important directions. Now that many of the cities and towns that have long been infested and have had State aid, not only in reimbursement, but also in supplies and machinery furnished, are gradually becoming self-supporting, it becomes the State's duty to render equal assistance to those towns and cities that have more recently become generally infested and are worthy of State aid.

The State appropriation at present is but a little over one-half of what it formerly was for moth work, and with materials greatly increased in cost, and labor more expensive, we are not in a position to do as much as heretofore. We are, however, getting more work done each year by individuals, and this, being self-supporting work, accomplishes results in the most satisfactory way. We, as a people, believe in self-reliance and self-help; the idea is associated with liberty and self-respect. Acting upon this principle, and with the belief that this is the true interpretation of the law, the State Forester has governed himself accordingly in dealing with the whole moth question. While the moth law plans for certain methods of assistance to towns from the State appropriation, this assistance is expected to be forthcoming only when it is a question of real need. One Massachusetts town deserves commendation in that while it spends large sums in excess of its liability, and could demand State reimbursement, it has never asked for one cent. The Commonwealth is to be congratulated upon such public-spirited communities as this.

A few of the main principles that the State Forester has endeavored to follow in moth work are: —

1. To develop a capable man in each city and town to have charge of the work, who has sufficient knowledge and experience to command the respect and confidence of his people.
2. To see that each town has sufficient modern equipment and materials to work with, and that they are properly cared for so that it is possible to accomplish good results.
3. To keep a practical working knowledge of moth conditions and estimates for getting results.
4. To avoid unnecessary expenses and keep the work as near self-supporting as possible.
5. To encourage private liability work, either by the local moth superintendent's force or private contractors. Whatever work is thus done lessens the infestation and betters conditions just so much, — a step in the right direction towards suppression and control.
6. To keep cities and towns that have become self-supporting from getting careless and indifferent, thus allowing bad conditions to return.
7. To assist owners of infested woodlands and forests in thinning or operating their stands, with a view to present economic utilization and future production.
8. To aid all our citizens in Massachusetts to deal with the moth problems in the very best and most economic and practical way.
9. To reduce in so far as practicable the overhead expenses of the work to a minimum, in order to make available as large funds as possible for accomplishing the practical work desired.

10. To keep at all times a clear, concise and sufficiently detailed account of the expenditures and reports of the State work, so that we may be able to inform the public how the work is being administered.

11. To co-operate with the United States government in retarding moth distribution and spread into new territory, and in aiding in the propagation and dissemination of beneficial parasites.

When we consider the voracious and tenacious habits of the gypsy and the brown-tail moth we realize the seriousness of the battle that has been fought here in Massachusetts. The State has been liberal and long-suffering and patient, but the task has been one of no small proportions, and there is still work to do. Last year, due to war conditions, we were very fearful for a while that we might be unable to get sufficient arsenate of lead for our spraying. We finally were fortunate in getting a million pounds from the west at practically double the price we had paid a few years before, and later some of our local manufacturers came to our assistance in smaller lots which carried us through the season. In order to get the larger amount into New England in time for our use due to embargoes upon railroads, a whole train load of arsenate of lead, consisting of twenty-nine cars with engine and full train crew, came through from the west intact, consigned to the State Forester of Massachusetts. The value of this cargo was $81,000.

Again this year we are fortunate in getting arsenate of lead at a favorable price, but a considerable increase over last year. We need to exercise, therefore, every precaution the coming season in the economic use of this insecticide. In labor, spraying machines and all other equipment there is a corresponding increase. Our appropriation, therefore, is only two-thirds as effective under present conditions as normally. The brown-tail moths are practically exterminated; for the past two years they have given us very little concern. The gypsy moths are controlled in the residential parts of our cities and towns, though our woodlands generally are infested throughout eastern Massachusetts. These woodlands are receiving attention, and through modern forestry methods of thinning, combined with good results from parasites and diseases, we are making substantial gains. This is no time for the pessimist.

The section of the State experiencing the worst infestation by the gypsy moths at present is that contiguous to Middleborough and Wareham, and further south on the Cape proper. In this region the heretofore scattering infestations have become general, and henceforth their treatment needs the same thorough methods that have been practiced in the sections in and about Boston for years.

Since the United States government has confined its attention to the control of the spread of the gypsy moth, the State Forester has not had the splendid assistance formerly given within our infested territory, and this assistance has been greatly missed.

With the government taking the responsibility of their present important work and the parasitic work, however, we can well afford to assume this extra duty, although in so doing our expense has been greater. All things considered, therefore, we feel that great and satisfactory progress has been accomplished. Without discussing the subject further, suffice it to say that we need the whole-hearted co-operation and assistance of our people in this work, as ever. We have greatly reduced our appropriation, but increased expenses in every way, due to war conditions, naturally form a great handicap. We expect your continued support and confidence in this work.

During the year the State Forester was called into conference with Mr. James J. Storrow, chairman of the fuel committee of the Public Safety Committee of Massachusetts, relative to a request from the English government for our furnishing lumber men from New England for work in Great Britain. Upon studying the matter further, I made a report recommending that we organize and equip a number of portable sawmill units similar to those commonly used in Massachusetts. From this as a beginning, under the leadership of Mr. Storrow and his active committee, it resulted that all the New England States became interested, and the project was carried out in a very creditable manner.

At the time that the ten sawmill units were being formed and equipped, a request came from Major Greeley of the Forest Service for aid in listing men for the Tenth Engineers' Corps or Forestry Regiment for service in France. The State Forester was made a recruiting officer for Boston and Massachusetts, and

Lieutenant Wolfe of the United States Forest Service was sent on to assist in the work.

More details regarding our war activities are given elsewhere in this report.

Forest fire work of the year has not changed materially from heretofore. Four new observation stations have been built during the summer, one at Prospect Hill, Waltham; one in the central part of Martha's Vineyard; one at Charlton; and the fourth at Ragged Mountain in West Brookfield. The season was a favorable one, due to frequent rain and conditions which kept the vegetation green and moist. The work of inspection of engines has been portioned out into districts, and is now done by the various district forest wardens instead of special inspectors, as heretofore. With our forest observation system and improved organization we are in better shape than ever for future emergency when dangerous seasons come.

The examination work of forest tracts, where assistance is given the owner in forestry thinning and management, has been larger than ever, as is shown elsewhere in this report.

Forest utilization has received its full attention throughout the year, and with high cost and fluctuation of labor, due to losing men who have gone to war, it has been a busy time keeping the work going. The high prices for lumber and cordwood have changed conditions very much. The cordwood that usually has been hard to dispose of is now in great demand for fuel, and at present we are exercising our ingenuity to aid all sections of the State in the campaign to cut wood for fuel and at the same time improve conditions in the woodlands. The "cut a cord of wood" campaign is just getting fairly under way.

During the past year a greater interest has developed in our State work in the care and protection of trees than has ever been shown before. The correspondence courses on shade tree management and forestry that were the outgrowth of arrangements made by the State Forester with the Massachusetts Agricultural College were heartily entered into by a large number of our men. The State Forester's division men, city foresters, moth superintendents and tree wardens were enrolled to the number of over 200. The very fact that this was a voluntary undertaking, initiated in response to a request from a few moth superintendents, and so heartily taken advantage of when offered, speaks for itself. When men take sufficient interest in their work to study nights and spare hours after working hard all day it shows they are interested.

Besides the above courses a splendid beginning was made the past fall in teaching these same men something of tree surgery. Arrangements were made to engage expert and experienced tree surgeons to hold demonstration schools in different sections of the State. The arrangements were made by the State Forester's division man in each case, and he was in immediate charge. It was indeed gratifying to see how readily and quickly this work was taken up by the men. It is proposed to continue this work the coming year. The past season the State Forester was much gratified to see the good work accomplished in such cities and towns as Taunton, Fall River, Springfield, Newton, Hudson, Leominster, Cohasset, Hingham, etc. The wholesome rivalry, where each man feels that his work is just a little better than the others, is also worth while. We have no desire to disparage the good work that is being done by reputable men or concerns who have accomplished splendid results, particularly upon the estates of many of our wealthy people. We do have, however, a great many trees in nearly every city and town that are needing attention at the hand of some one who is sufficiently trained and experienced to do the work intelligently, and there is plenty of work for many years to come for both the local official and the expert.

While correspondence courses on shade tree management and forestry, the practice of tree surgery, etc., are not the real field of the State Forester, nevertheless this office is constantly looked to by our people for assistance in this work. As a matter of fact, men who have had training in general forestry work are in a position to readily advise and assist in this work, as the fundamentals for success are the same. What is true of the above work is equally true of the diseases and insects common to our trees. When, therefore, last year, at the instigation of the Massachusetts Tree Wardens and Foresters Association, a bill was recommended to the Legislature for unifying the work that has to do with shade and forestry trees in general, it was believed that the time was ripe for such a step.

The bill provided for a forester in each town or city, whose duty should be to exercise the authority now vested in the offices of moth superintendent and tree warden, since it was felt that one person held responsible is more likely to get results than where the responsibility is divided. It did not pass. Perhaps its advocates are mistaken in their judgment that such a step would really be productive of good results. Until the responsibility is legally placed upon this department by the Legislature, it is in no way to blame for the maltreatment of the trees that are destroyed or disfigured by lumber, power, electricity, gas and telephone companies. The abuse of the street and roadside trees is constantly thought to be due to neglect on the part of the forestry department. It is but natural that this department should desire to make it clear that this is not the case.

The results of the cleaning work done about the shores of cranberry bogs for a certain distance back, which has been in progress for the past two seasons, thus checking the invasion of the gypsy moth larvæ, have fully demonstrated its usefulness the past season. The satisfactory conditions were brought out in one question put to the State Forester, when the feeding of the insects was at its height, by one of the members of the Cranberry Growers Association committee, who has shown great interest in the work. "Well, what would have been the conditions now, Mr. Rane, if we had not begun when we did?" The cranberry interests are large in Massachusetts, and the co-operation shown has been of the best.

The white pine blister rust that has been so prominently called to the attention of people in recent years as a menace to the white pine has received more consideration than ever during the past year in Massachusetts. The State appropriation allotted to this work was $50,000, and the United States government was expected to spend in the State an equivalent amount. Though this work was not directly under the supervision of this department, the State Forester's organization was used by the State and government officials in carrying out the methods and plans outlined. The report of this season's work has not been received as yet, but it is hoped that some real progress will be forthcoming. In the spring the State Forester destroyed several infestations that had been found the previous season, at a time when the infested pines were just beginning to show the fruiting spores. It will probably take time to more fully determine many important matters regarding this disease. The State Forester's Department was not responsible for the destruction of the currants and gooseberries this year, as this work was in direct charge of the State Board of Agriculture.

The three auto-truck traveling sprayers that were built for the department were used continuously throughout the season, and proved great factors in the success of the season's work. By being able to cover a much larger territory than would be possible with horse-drawn sprayers, a saving was made in both team hire and men, which is of great importance in these times.

The State Forester has addressed many important organizations during the year, chief among which have been the North Eastern Lumbermen's Association at Bangor, Me.; the New England Nurserymen's Association at New Haven, Conn.; the Society for the Promotion of Agricultural Science at Washington, D. C.; the Eastern Shook and Wooden Box Association at Boston; the Massachusetts Horticultural Society (Lowell lecturer); and the Forestry Club of the University of Maine. Other addresses, talks and meetings attended by the State Forester and his assistants this year are listed in the latter part of this report.

Other matters of importance are emphasized more in detail in this report. Your continued hearty co-operation is expected throughout the coming year by the State Forester and his co-workers and assistants.

ORGANIZATION.

There have been relatively few changes in the personnel of the working force during the year.

The general office staff remains exactly the same as last year. Among the foresters, Mr. Chas. R. Atwood, B.Sc., who was stationed at Springfield, resigned to accept the supervision of one of the sawmill units sent to England, and Mr. Herbert E. Henshaw, who for a few years previous to entering the New York College of Forestry was a foreman in the department, was appointed to fill Mr. Atwood's old position. One of the forestry foremen, Mr. J. L. Peabody, and also Mr. R. F. Wilder have joined the colors, and are with the Twentieth Forestry Regiment, and Mr. Ainsley C. White has enlisted in the navy.

Of the moth men Mr. J. A. Farley, who was connected with the work of moth suppression for a great many years, resigned on November 21 last.

The forest fire districts have been made into five instead of four, while the positions of locomotive inspectors have been abolished, and this work distributed to each of the districts.

There have been some changes among the observers in the fire towers. Mr. Henry H. Hammond of the Chelmsford tower has died. He was a very faithful and enthusiastic forest-fire observer.

The redistricting of the moth work has been made with reference to county lines.

The present organization of the department is as follows: —

GENERAL STAFF.

F. W. RANE, B.Agr., M.Sc.,	State Forester.
C. O. BAILEY,	Secretary.
ELIZABETH HUBBARD,	Bookkeeper.
ELIZABETH T. HARRAGHY,	Stenographer.
JENNIE D. KENYON,	Stenographer.
MABEL R. HAMNETT,	Clerk.
ROBERT HARDING,	Office boy.

GENERAL FORESTRY.

F. W. RANE, B.Agr., M.Sc.,	State Forester.
H. O. COOK, M.F.,	Assistant forester in charge.
W. D. CLARK, M.F.,	Assistant forester (Amherst).
J. R. SIMMONS, B.Sc.,	Reforestation work.
C. R. ATWOOD, B.Sc.,[1]	Assistant forester.
HERBERT E. HENSHAW,	Assistant forester (Springfield).
JAMES MORRIS,	Assistant.
EBEN SMITH,	Superintendent, Barnstable Nursery.
J. A. PALMER,	Superintendent, Amherst Nursery.
L. W. BRYAN,	Superintendent, State Farm Nursery.
J. L. PEABODY,[1]	Field foreman.
AINSLEY WHITE,[1]	Field foreman.
H. N. BUTLER,	Field foreman.
H. H. CHASE,	Field foreman.
FRED W. PARKER,	Field foreman.
JOHN H. SAXTON,	Field foreman.

---

[1] Enlisted.

MOTH WORK.

Staff.

F. W. Rane, B.Agr., M.Sc.,	State forester.
George A. Smith,	Assistant (equipment, accounts, etc.).
Paul D. Kneeland, M.F.,	Assistant (woodlands, products, etc.).
Guy W. Lucas, B.Sc.,	Assistant.
Lithgow Hunter,	Assistant.
John W. Enwright,	Assistant.
John J. Fitzgerald,	Assistant.
Francis V. Learoyd,	Supplies.

District Moth Men.

1. Saul Phillips, Beverly.
2. Wm. A. Hatch, Marlborough.
3. C. W. Parkhurst, Foxborough.
4. W. F. Holmes, Wareham.
5. Harry B. Ramsey, Worcester.

FOREST FIRE PREVENTION.

Staff.

F. W. Rane, B.Agr., M.Sc.,	State Forester.
M. C. Hutchins,	State Fire Warden.
Josepha L. Gallagher,	Clerk.

District Forest Wardens.

1. Jos. J. Shepherd, Pembroke.
2. Miner E. Fenn, Needham.
3. James E. Moloy, Woburn.
4. John P. Crowe, Westborough.
5. Albert L. Ordway, Westfield.

Observers.

Calvin C. Parker, North Harwich.
Joseph Jenkins, Barnstable.
W. I. Moody, West Falmouth.
Walton F. Raymond, Bournedale.
F. L. Buckingham, Kingston.
D. M. Smith, Waltham.
Lawrence E. Sampson, Middleborough.
John H. Montle, Fall River.
R. J. Zilch, Rehoboth.
Chas. F. Kimball, Hanson.
Edward D. Sprague, Hingham.
John H. Bacon, Sharon.
Mrs. Wm. Day, Martha's Vineyard.
F. R. Stone, Sudbury.
John H. O'Donnell, Wakefield.
Lewis F. Hammond, Chelmsford.
Frederick W. Aldrich, Georgetown.
Myles O. Burnham, Manchester.
Robert McLaughlin, Mendon.
John Roche, Westborough.
James Maley, Princeton.
Wm. E. Taylor, Warwick.
George W. Clifford, Pelham.
George B. Sherman, Brimfield.
Charles Putnam, Westfield.
N. C. Woodward, Shelburne Falls.
H. H. Fitzroy, Savoy.
Elmer Hunt, Chester.
John E. Curtin, Tolland.
Clayton Bunk, Great Barrington.
Robert Miller, Pittsfield.
Clifford George, Williamstown.

For list of forest wardens and local moth superintendents, see page 89.

A large plantation of red pine transplants in the Barnstable Nursery. As this species is in great demand for use in mixed plantations with white pine, they are at present a very valuable stock. These trees will be used largely in our State work. Red pine seed is not to be had this spring.

White pine transplants that were set among scrub oak or acorn brush on Martha's Vineyard following a forest fire. The small trees were four years old when set three years ago, and have grown on an average from 1 to 2 feet each year during the past two years. They will undoubtedly overcome the oak.

This plantation is on the fish and game farm in the center of the island. A tract of 20 acres joining this planting was set out the past season for the Commission by this department, the species used being a mixed planting of white and red pine.

War Activities.

This department has been fortunate in being able to help along the lines of war and emergency work probably more than any other State department except those especially created for the purpose. In fact, the moth thinning and utilization branch of the department is devoting practically all its energies along war lines. The war has created a tremendous and unforeseen demand for woods labor, which we have helped to supply. The fuel emergency has created a necessity for increased use of cordwood as a substitute for coal. We are helping to increase the production and supply the demand. We are supplying the army with considerable wood at a lower price than any private individuals, and thus saving the government money.

Sawmill Units sent to England.

Last April, soon after the declaration of war, Mr. Storrow, chairman of the Committee on Public Safety, received a cablegram through Colonel Gaston, from the British War Office, stating that America could help more just then in furnishing men and equipment to produce lumber and wood in England than in any other way. On account of the lack of transports it is impossible to ship the lumber from this side, and so it must be produced over there, as lumber is vitally necessary. Mr. Storrow immediately got in touch with the State Forester, and from the plans drawn up then, the ten sawmill units were organized, equipped and sent. Most of the lumbermen of New England helped in the work, but this department was the center of the activities. The State Forester acted as secretary of the general committee which had charge of the organization of the mill units. Mr. Kneeland served on three of the subcommittees which furnished the mills, the camp equipment and the men. He devoted his entire time for a month to the work. Mr. Cook, Mr. Lucas and Mr. Hunter gave considerable of their time. Charles R. Atwood, western Massachusetts field agent, went as foreman of Unit No. 1. Twelve of the woodsmen who had been working for the department went with him. Therefore this department feels that it was responsible, more than any other single body, except the Public Safety Committee, for the success of the expedition. Within thirty days from the time the start was made, 360 experienced woodsmen with their complete equipment, everything from sawmill boilers to bean pots, including 120 horses, were placed on shipboard. The States and lumbermen of New England raised the $150,000 to pay for them, and sent them as a gift from New England to Old England. They are now producing lumber twice as fast as anybody has done before over there with similar equipment, and doing it for half the cost. New England may well be proud of its sawmill units, and this department of its share in them. Mr. Atwood writes in October that Unit No. 1, Massachusetts State Forester's Unit, has a record for production, having cut out 18,000 feet of sawed lumber in one day. These mills began work in Scotland, some of them being on the Carnegie Estate at Ardgay, County Rosshire.

Recruiting for Forestry Battalions.

Immediately following the sawmill units, this department was requested by the United States Forest Service to assist in raising men for the so-called Forestry Battalions of the United States Army Engineer Corps. The State Forester was appointed listing agent for the recruiting of the men. For a while office room was provided for one of the officers of the regiment who aided in the listing. Since then Mr. Lucas has acted as listing agent, examining over 300 men of whom about 40 were accepted. Five different press notices were sent to the newspapers of New England to aid in the listing, and several hundred letters were answered concerning these battalions. Several of our men have already gone in them, and Mr. Kneeland and Mr. Cook were offered commissions. We are glad they did not go, as they can be of more service here.

Furnishing Wood to the Army.

Last year about 5,000 cords of wood were cut in thinning operations under our supervision. It has been possible for us to furnish about 1,400 cords of this wood to the army at a considerable saving. About 100 cords were furnished to the camp at Framingham at $5 a cord, — less than they had been paying private contractors. About 300 cords were furnished to the forts in Boston Harbor at several dollars under the market price. One thousand cords are being furnished to Camp Devens at a lower figure than for any wood furnished by other contractors. We also have reason to believe that by our action we have kept the prices of the wood furnished by private individuals at a more reasonable level than would have been the case otherwise. We have offered to furnish all the wood to the army at cost plus a reasonable profit, but, due to its system of contracts, the Quartermaster's Department has been unable to accept our offer. We are now cutting wood which we hope to furnish to the army on that basis another year.

FUEL EMERGENCY.

Last spring we saw the present wood shortage coming. Most of the stocks of dry wood had been exhausted and green wood was being used. Several statements were issued in which it was urged that more wood be produced as a matter of profit. Now the coal shortage has made the greater production and use of wood a war measure and a patriotic necessity. Last summer we called upon the Committee of Public Safety to help us in producing wood, but they did not deem it expedient at that time. Lately, however, the situation has become so acute that a Wood Fuel Committee has been formed to increase the wood supply. The State Forester is an active member of this committee. All possible efforts are being made through the regular channels of the thinning work to heighten wood production. A special wood-sawing machine will soon be in operation by which it is hoped that wood can be produced for the same price with regular day labor as with the cord labor, which is now almost impossible to obtain. If this machine succeeds, we hope to place several others in operation before spring. They will have a capacity of about ten cords a day. A bulletin to encourage the use and production of wood for fuel has been printed by this office. Wood will be even more necessary and important next winter than it is this, and we are bending every effort to help, and are willing to help even more if the capital can be provided. Whether the war ends soon or not, the Massachusetts woodlot will have to do a great deal toward keeping our homes warm and our industries running. All who want help in the wood question are invited to call on us.

UTILIZATION.

Special efforts have been made along the lines of utilization this past year. The idea of proper utilization is to prevent waste, and to put the tree into the products for which it is best suited, and from which the highest returns will be received. On our co-operative operations we have experimented with various kinds of products, and have thus obtained valuable practical information and data. The charcoal experiment was completed and the product has been sold. The results show that for wood at a distance from the market or the railroad, and for wood of inferior quality, charcoal has distinct commercial possibilities. We hope to publish a report on the matter a little later. Considerable practical advice on utilization has been given and used to advantage even by lumbermen. We have sold or helped to sell both wood and lumber for their producers, and are willing to help anybody along those lines without charge. We hope to be able to expand the utilization work to much larger scope in the near future, for the practice of forestry is greatly encouraged by giving the small owner of forest land an accurate idea of the use and value of forest products. With this knowledge he, the permanent holder of the land, is able to profit rather than the lumberman, whose only idea is necessarily the rapid conversion of the woodland he owns into profit.

OPERATIONS.

During the past year fifteen co-operative operations have been carried on. A list follows: —

NAME OF OWNER.	Location.	Area (Acres).	Character of Operations.
Cochituate Realty Trust,	Wayland,	40	Sawmill.
Mrs. Currier,	Pembroke,	12	Cordwood.
Joseph S. Fay, Jr., Estate,	Falmouth,	200	Sawmill and spraying.
George B. Fiske,	Wayland,	10	Sawmill.
Clifton Johnson,	Hadley,	5	Sawmill.
Karlstein Estate,	Dedham,	15	Cordwood.
William M. Kiely,	Hadley,	2	Sawmill.
Lawrence Minot,	Wareham,	80	Cordwood.
H. C. Mulligan,	Wayland,	25	Sawmill.
E. R. Peirce,	Weston,	50	Cordwood.
Arthur G. Rotch,	Lakeville,	150	Sawmill.
J. J. E. Rothery,	Sandwich,	50	Cordwood.
Joseph A. Skinner,	Hadley,	90	Sawmill.
Robert K. Snow,	Wayland,	20	Cordwood.
Robert Winsor,	Weston,	125	Sawmill.
Total,		874	

On these operations $50,168.81 have been spent from the capital furnished by the owners of the land; 1,470,055 feet of lumber, 9,730 railroad ties and 4,630 cords of wood have been cut. The gross returns from these operations to the owners have been or will be about $75,000, leaving a net profit to the owners of about $25,000. In expense is included the cost of burning brush and even of spraying in several cases. Thus it will be seen that the work was profitable. In all these operations the proper practice of forestry, that is, the removal of trees that should be cut because they were damaged or mature, and the leaving of trees that were of greater value for the future of the land, was the prime consideration rather than the gaining of the highest financial returns. However, in several cases larger returns were realized than could have been obtained by selling the growth to some lumberman who would have cut regardless of the future.

WALPOLE MUNICIPAL FOREST.

The second celebration by the townspeople of Walpole, in which all of the school children joined, was held on Arbor Day this year. Appropriate exercises were held in which the State Forester took part. At the close of the exercises each person present was requested to plant a tree in the town municipal forest. This sight in itself was interesting and well worth while. This beginning was made possible through the generosity of two public-spirited townsmen, Mr. Charles Bird, Jr., and Mr. Geo. Plympton, who conceived the idea and had it so well carried out. The example is one that will be followed, it is believed, by other cities and towns. It was a pity that a moving picture could not have been made of the hundreds of children when they were all so busily engaged in planting. It was a picture well worth preserving.

This town or municipal forest, which is now over two years old, is in close proximity to the schools and playgrounds, and will, it is predicted, prove a great and lasting tie of fellowship between the present and future generations, and besides, prove an object-lesson in practical conservation.

REFORESTING SCRUB OAK OR ACORN BRUSH LANDS.

It is believed that this class of lands which is so common on the Cape, and found here and there occasionally in other sections of the State, as on the Montague and Westfield plains, can be handled readily so that they may be reclaimed for forestry. These lands are not infrequently burned over by forest fires, and if the area is at once set in the early spring to pine transplants, preferably strong four-year-old stock, good results will ensue if the season is favorable. Our practice is to set the transplants in the open spaces between the brush, and to determine the number to plant per acre by the openings available. Generally speaking, these openings are well spaced and offer ideal conditions for work. Small white pine transplants that were handled in this way in various places are giving very encouraging results. A photograph of a planting made upon the game farm on Martha's Vineyard may be seen in this report. The photograph was taken by the State Forester on September 21 of this year, and it will be observed that the pines have made an average growth for each of the past two seasons of a foot each. That the pines have established themselves and will be able to subdue the scrub oaks there is little doubt. The transplants have been set three years in their present place. It is believed that when the pines are well established the oaks will be really of assistance, as they shade the ground in summer, and their leaves afford a mulch on the ground at other seasons of the year. Where the scrub oak is thick and large the expense of clearing it renders the undertaking impracticable, but if it can be burned over by a hot fire which is within control the conditions for planting are then considered very favorable. These experiments will be watched with interest.

THE ORIENTAL HAG MOTH.

A very severe outbreak of this insect occurred during the last summer season. This is an imported insect, found first in Dorchester in 1906. It is a very voracious feeder, and this past season stripped many fruit trees in Dorchester and Roxbury. It is hatched from the egg in July and feeds all summer, forming a hard, woody, egg-shaped cocoon the latter part of September or first of October. It remains as a larva in the cocoon all winter, changing to a pupa in spring and emerging an adult moth in the latter part of June. The moth then lays its eggs on leaves or twigs. Though the presence of this insect has been known since 1906, it has not spread to any extent until this season. The numbers of the insects have not seemed to be on the increase, perhaps owing to the birds or to some other unknown agency. This fall cocoons have been found as far from the original infestation as Canton. We feel it our duty, therefore, to warn the public of the danger from this insect. The larvæ have nettling hairs, and care should be used in handling them. They are also very voracious, and will strip a tree in a short time when they are plentiful. It is possible that two or three favorable seasons may greatly increase the numbers of this insect, and render it a formidable insect enemy. It is, of course, controlled by spraying at the proper season, but this will not be the same time that spraying is done for the gypsy moth. We hope that this word of warning will be unnecessary, but we feel that all persons interested in insect suppression should be on their guard.

The Tussock Moth.

This insect has been in evidence in most sections of the State during the past season. The outbreaks at Pittsfield and Nantucket were particularly heavy. The writer has never seen so many pupæ and egg clusters as in a single colony which extended over about half an acre in the city of Pittsfield the past fall. The larvæ had literally stripped several maple trees, and the white patches practically covered everything in sight. Besides the tree trunks and limbs, telephone poles, fences, etc., were one white-coated mass. At Nantucket the infestation was generally bad throughout the town. Their natural enemies evidently were unable to keep them in check. Fortunately these insects are held in check by the same methods as are used in handling the gypsy moths, namely, by creosoting the egg masses and spraying with arsenate of lead when the larvæ are eating in the spring or summer.

FORESTRY CO-OPERATION.

Co-operation has always been a keystone in the work of the Massachusetts Forestry Department, — co-operation with the town, co-operation with other governmental agencies, and co-operation with the individual landowner. It has been our belief that a dollar of the money of the Commonwealth placed with several more contributed by town or individual, and used for forest protection or development, is more profitable for the State as a whole than the same dollar used exclusively in State work, and town or individual left to shift for themselves. In the gypsy moth and fire protection work co-operation is largely with the town, while in the utilization and forestry branches co-operation is largely with the private individual. We have added to our co-operative agencies this year the county farm bureaus. There is now one of these bureaus in each county of the State save Nantucket. These farm bureaus act as the local representatives of the United States Department of Agriculture and the Massachusetts Agricultural College, and it is our plan to make them feel that they are also representative of this department as well. To this end we have supplied them information and literature regarding the work of the department, supplied press articles for their monthly bulletins, and in other ways maintained personal contact with them. The county agents have responded to this invitation for co-operation in a most gratifying manner, and although the work is but three months old it gives indications of being a most useful experiment. Several counties also maintain agricultural schools, and these offer an inviting field for co-operation in educational work which should bring fine results. The work of teaching in these schools, and keeping in touch with the county agents, might well occupy the entire time of one assistant, and if the right man could be found would prove a valuable addition to our force.

ACTIVITIES IN GENERAL FORESTRY.

Because of the varied nature of the work of this branch of the forestry department it is difficult to express it in figures, yet the following summary may be of interest: —

Reforestation lands: —
  New plantations set out, 12; 400 acres; 300,000 trees.
  New plantations brushed, 8; 142 acres.
  Old plantations brushed, 10; 225 acres.
  Old plantations filled in, 6; 40,000 trees.
Otter River State Forest: —
  Planted, 60 acres; 47,000 trees.
  Brushed, 70 acres.
Nurseries: —
  Transplants shipped from, 900,000.
  Seedlings transplanted in, 1,560,000.
  Seed beds put in, 430.
Examinations of woodlots, 104; 5,000 acres.
Surveys, 7 lots; 250 acres.
Operations supervised, 11; 150 acres.

FORESTRY EXAMINATIONS.

The examinations of private property made this year exceed in number those of previous years. It is not to be supposed that an examination ends with a visit to the land and the advice given the owner, but our service is extended to finding purchasers for the cut of standing wood, or obtaining men to do the work which was advised. There have been an unusual number of applicants seeking estimates and buyers for the standing wood and timber on their woodlots. This is due to the rapidly advancing prices of forest products, which have made many owners think of disposing of their woodlots. Some States do not make estimates, on the ground that such assistance is not the work of a forestry department, and that people should be willing to hire professional estimators for such work. We believe, however, that assisting the landowner to dispose of his woodlot, provided it is economically operated, is a legitimate part of our business, and helps in the proper use of our forests. This department welcomes and is glad to further the work of reputable professional estimators, and give reference to them for such work. We want the landowners to understand that in making estimates of woodlots this department must be fair to the possible purchasers as well as to the owners, and that we cannot make our valuations high to satisfy the seller at the expense of the purchaser.

The following table shows the kind and variety of work that this department has been able to do in aiding our forest owners throughout the State for the past year. Again, this is independent of the moth-thinning work, which is of equal importance, although carried on by another division.

LIST OF FOREST EXAMINATIONS, 1917.

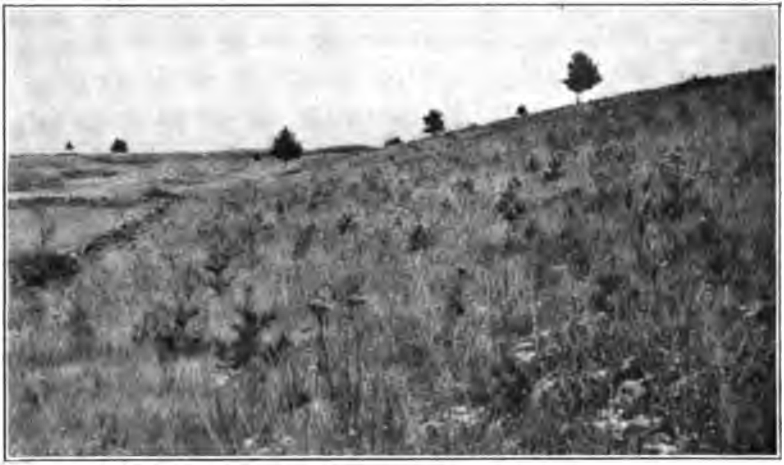
Name.	Town.	Area (Acres).	Problem.
Ashton, Harriett,	Middleton,	50	Cutting.
Bacon, F. W.,	Newton,	5	Trimming and cutting.
Baxter, Adelaide A.,	North Weymouth,	27	Thinning.
Bell, E. H.,	Southampton,	200	Cutting, thinning and estimate.
Bemis, A. A.,	Spencer,	90	Chestnut blight.
Bill, N. B.,	South Worthington,	40	Blister rust and weevil.
Brooks, Merrill D.,	West Granville,	30	Thinning.
Brown, Alice M.,	Williamstown,	30	Cutting.
Brown, Charlotte,	Concord,	8	Cutting.
Burnham, F. E.,	Essex,	40	Blister rust.
Cambridge, city of,	Fresh Pond,	10	Aphis.
Channing Sanitarium,	Wellesley,	50	Chestnut blight thinning.
Chapin, C. H. B.,	Tolland,	300	Cutting and planting.
Clark, A. B.,	Palmer,	25	Chestnut blight cutting.
Cook, Martha, Heirs,	Stowe,	36	Cutting.
Curtis, Miss R. E.,	Brighton,	1	Tree diseases.
Dexter, Mr.,	Blandford,	5	Insects.
Durant, Clark T.,	Great Barrington,	6	Thinning and planting.
Eastman, Chase,	Newton,	6	Thinning and insects.
Fall River, city of,	South Park,	-	Tree diseases.
Fessenden, R. G.,	Concord,	40	Improvement thinning.
Fengstedt Bros.,	Bedford,	20	Estimate.
Fitspatrick, T. B.,	Hopkinton,	50	Thinning, insects and diseases.
Forant, Mrs.,	Warren,	40	Thinning.
Framingham Country Club,	Framingham,	8	Cutting and thinning.
Frothingham, Mrs. Channing,	Walpole,	46	Thinning.
Frothingham, Randolph,	Beverly Farms,	-	Blister rust.
Gay, George M.,	Hampden,	75	Chestnut blight thinning.
Geer, J. T.,	Three Rivers,	30	Thinning and planting.
Gillett, Edgar L.,	Westfield,	150	Estimate.
Goodale, J. L.,	Ipswich,	10	Blister rust and planting.
Goodwin, Fred S.,	Dover,	185	Thinning.
Hall, H. P.,	Sandisfield,	200	Planting.

LIST OF FOREST EXAMINATIONS, 1917 — *Continued.*

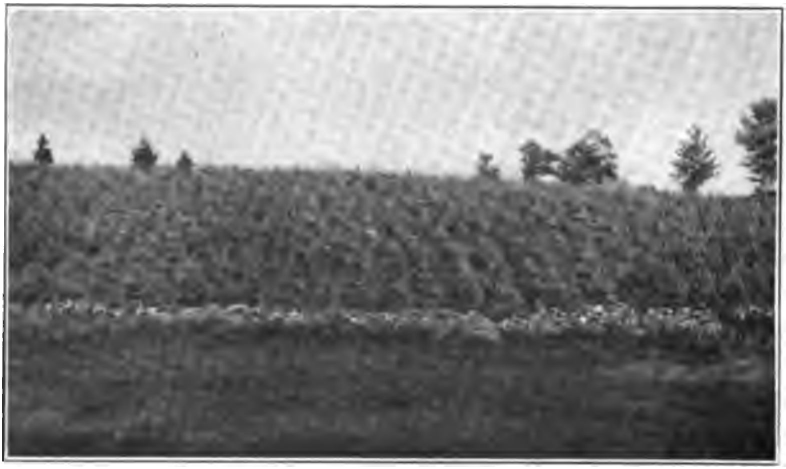
NAME.	Town.	Area (Acres).	Problem.
Heald, J. M.,	Lincoln,	20	Thinning and planting.
Healy, John J.,	Charlemont,	180	Cutting and improvement thinning.
Helburn, J. W.,	Williamsville,	190	Thinning and planting.
Hillside School,	Greenwich Village,	20	Cutting.
Homans, Mrs. John,	Canton,	10	Thinning and planting.
Johnson, Margaret,	East Freetown,	70	Thinning and cutting.
Knittle, Fred,	Blandford,	50	Thinning.
Lawrence, H. H.,	Concord,	77	Thinning.
Leclear, Mrs. Gifford,	Brewster,	38	Thinning and planting.
Leonard, Fannie G.,	Raynham,	16½	Reforestation.
Lowney, Walter M.,	Mansfield,	4	Weevil.
Loyd, Mrs. S. L.,	Williamstown,	4	Estimate.
Ludden, Myron,	Spencer,	30	Cutting and estimate.
Lynch, J. C.,	Stockbridge,	70	Planting.
Marble, Frank E.,	Lynnfield,	20	Burn.
McSweeney, Edward F.,	Hudson,	6	Burn.
Meadowbrook Golf Club,	Reading,	10	Thinning.
Melbourne, Sydney J.,	East Longmeadow,	57	Cutting.
Melbourne, Sydney J.,	East Longmeadow,	75	Cutting.
Metropolitan Park Commission,	Blue Hills,	-	Blister rust.
Morse, Arthur M.,	Sudbury,	10	Thinning and planting.
Morton, Margaret B.,	Plymouth,	-	Shade trees.
Munroe, Elmer E.,	Wellesley,	3	Tree diseases.
Munson, W. A.,	Huntington,	50	Cutting and chestnut blight.
Newburyport Water Commission.	Newburyport,	40	Thinning and planting.
Newburyport, city of,	Newburyport,	-	Tree diseases.
New England Kennel Club,	Braintree,	40	Thinning and planting.
Nichols, Lesley A.,	North Reading,	4	Thinning and spraying.
Norfolk State Hospital,	East Norfolk,	25	Thinning and planting.
Osgood, Isaac,	North Andover,	10	Thinning and estimate.
Packard, Martha W.,	Andover,	1	Spraying.
Palmer, Mrs. E. H.,	Reading,	6	Blister rust.
Parker, Charles H.,	Cotuit,	75	Thinning.
Peck, Robert E.,	Brimfield,	50	Blister rust.
Peters, William Y.,	Dover,	116	Thinning.
Phelps, James F.,	West Lynn,	1	Chestnut blight.
Phinney, F. F.,	Sturbridge,	200	Thinning and planting.
Pond, George K.,	Leyden,	80	Planting.

LIST OF FOREST EXAMINATIONS, 1917 — *Concluded.*

NAME.	Town.	Area (Acres).	Problem.
Prengle, Ralph,	North Reading,	5	Thinning and spraying.
Richardson, Miss Clara,	Methuen,	14	Estimate.
Ross, John A., Jr.,	Newburyport,	45	Thinning.
Sabin, Mr.,	Hadley,	22	Thinning.
Seavey, Herbert,	Stoughton,	80	Chestnut blight cutting.
Seymour, Mrs. S. P.,	Granville,	100	Estimate and type map.
Shaylor, W. M.,	Tyringham,	42	Estimate.
Shaylor, W. M.,	Warren,	83	Chestnut blight.
Shores, Harvey T.,	North Bernardston,	400	Thinning and planting.
Simpson, C. B.,	South Easton,	4½	Burn.
Skinner, Joseph A.,	South Hadley,	25	Reforestation.
Smith, Irving,	Ashburnham,	150	Estimate.
Smith, Frank B.,	Worcester,	250	General.
Snow, F. H.,	Conway,	50	Thinning and planting.
Stearns, Francis N.,	Adams,	-	Moths.
Stockbridge, town of,	Stockbridge,	53	Improvement cutting.
Swift Estate,	Wellesley Hills,	10	Chestnut blight thinning.
Thompson, George M.,	Wakefield,	-	Aphis.
Wilkins, James H.,	Carlisle,	24	Thinning.
Williams, H. S.,	Springfield,	25	Cutting.
Windsor, S. S.,	Walpole,	1	Shade tree.
Woods, Nesbit L.,	Dunstable,	150	Cutting and planting.
Daniels, Caroline T.,	Medway,	30	Estimate.
Haven, F. S.,	Weston,	15	Thinning.
Hunt, Daniel,	Marshfield,	20	Thinning.
Keith, Harry,	East Bridgewater,	4	Blister rust.
Newburyport, city of,	Newburyport,	-	Tree diseases.
Parmenter, H. F.,	Wayland,	8	Estimate.
Pearson, Gardner W.,	Dracut,	80	Reforestation.
Plymouth Water Works,	Plymouth,	20	Thinning and planting.
Spencer, Geo. P.,	Oakham,	60	Thinning.
Weld, Stephen M.,	Dedham,	50	Blister rust.
Wheeler, William,	Concord,	16	Cutting.
Total (104 examinations),	. . . . .	5,308	



One of the tracts turned over to the State Forester and planted under the reforestation act, showing the young white pine trees just beginning to free themselves through the grass and weeds.



A photograph taken just three years later of the same plantation as above. This view was taken from the field on the left in the above view looking on to the hill (Christian Hill, Colrain).

REFORESTATION.

The number and area of plantations deeded to us under the terms of the reforestation law exceeded those of last year, and is well up to the average of previous years when the lots which were purchased are deducted from the total. The amount of caretaking work done on plantations of previous years was about the same as that done in 1916. The tables give this information in detail. The small motor truck which we purchased last fall was of great assistance in transporting men and trees, and enabled us to do more work with fewer men, an important consideration in these times of labor shortage. Several of our plantations showed an unusual number of trees affected by pine weevil. During the summer we used two crews of men making a tree-to-tree inspection of these plantations and cutting and burning the infested shoots. Experiment has shown that if this method is followed for two or three years the weevil can be controlled in great part.

NEW WORK.

[S. p.=Scotch pine; w. p.=white pine; r. p.=red pine; s.=spruce; A. p.=Austrian pine.]

Number.	NAME.	Town.	Area (Acres).	Trees planted.	Acres brushed.
134	Crocker,	Barnstable,	32	15,000 S. p.	32[1]
133	Simpkins,	Yarmouth,	12	7,500 S. p. 7,500 w. p.	12
136	French,	Rutland,	26	9,000 w. p. 9,000 r. p.	-
137	Wire company,	Spencer,	8	4,500 w. p. 4,500 s.	-
139	Perry,	Falmouth,	18	1,750 A. p. 1,750 S. p.	9
140	Snow,	Conway,	74	21,000 w. p. 22,000 s.	-
141	Pond,	Leyden,	61	20,000 w. p. 20,000 s.	-
143	Town,	Berkley,	12	-	12
144	Flint,	Andover,	6	2,000 w. p. 2,000 A. p.	-
145	Schoonmaker,	Ashburnham,	38	15,000 w. p. 5,000 s. 9,000 r. p. 5,000 A. p.	-
147	Geer,	Belchertown,	6	3,000 w. p. 3,000 A. p.	-
148	Sills,	Shelburne,	33	13,000 w. p. 10,000 s.	-
150	Estabrook,	Fitchburg,	7	-	4[2]
151	Estabrook,	Lunenburg,	6	-	2[3]
124	Hansen,	Marlborough,	95	18,000 w. p. 14,000 r. p. 4,000 S. p.	60
135	Smith,	Barnstable,	10	-	10
	Totals,		445	-	140

---

[1] Thirty cords of wood were taken out.

[2] Twenty cords of wood were taken out.

[3] Twenty-five cords of wood were taken out.

MAINTENANCE WORK.

[W. p.=white pine; A. p.=Austrian pine; N. s.=Norway spruce; r. p.=red pine.]

Number.	NAME.	Town.	Area (Acres).	Trees planted.	Acres brushed.	Trees from which Weevil was taken.
1	Fenno, . . .	Westminster, . .	40	–	–[1]	150
7	Flint, . . .	Andover, . .	40	10,500 w. p. 1,000 A. p.	–	–
13	Wilson, . . .	Spencer, . . .	5½	–	5½	337
12	Wilson, . . .	Spencer, . . .	23	–	–	463
11	Wilson, . . .	Spencer, . . .	45	–	–	1,405
20	Eames, . . .	Paxton, . . .	55	–	–	1,704
25	Sohier, . . .	Rowley, . . .	8½	1,000 w. p.	–	–
27	Greenwood, . .	Gardner, . .	93	–	–	4,000
30	Cowles, . . .	Belchertown, . .	10	–	10	150
43	Barr, . . .	Spencer, . . .	–	–	–	56
44	Clark, . . .	Holden, . . .	–	–	–	250
45	Stone, . . .	Brookfield, . .	–	–	–	520
46	Fullam, . . .	West Brookfield, .	115	9,000 N. s. 5,000 w. p.	–[2] 30	–
52	French, . . .	Hubbardston, .	40	–	40	–
59	Bolton, . . .	Shirley, . . .	20	–	20	–
73	Walworth, . .	Barre, . . .	35	–	25	–
81	Glasier, . . .	Leverett, . .	24	–	24	–
82	Glasier, . . .	Leverett, . .	66	–	66	–
112	Perry, . . .	Medfield, . .	12	1,000 r. p. 1,000 w. p. 500 N. s.	–	–
114	Tower, . . .	Manchester, . .	4	500 w. p.	–	–
119	Browne, . .	Marlborough, . .	33	6,000 w. p.	14	–
91	Rice, . . .	Spencer, . . .	200	–	–	4,355
75	Robertson, . .	Oakham, . .	85	–	–	587

[1] Thirty cords of wood were taken out.

[2] One hundred and sixty cords were taken out.

NURSERY WORK.

No important changes were made in our nursery work during the year. Our three principal nurseries at Amherst, Barnstable and the State Farm were continued as usual. The shipments of stock for planting on our own lands were somewhat greater than in the previous year, while the demands for stock by agencies outside of our department were considerably less. The amount of transplanting at Amherst and Barnstable was about the same as last year, but the transplanting work at the State Farm was very considerably restricted by the lack of two-year seedling stock. Some transplants were set out at the auxiliary nurseries at the Myles Standish State Forest and at Norfolk State Hospital, but no more stock was transplanted at the Otter River State Forest. In spite of advancing labor costs the nursery expense was about the same as last year, and considerably less than two years ago. The outstanding feature of our nursery situation at this time is the immense number of four-year transplants, nearly 2,000,000, which we have on hand for use next spring. As this number is double the number required for our own needs we have decided to make use of the privilege granted to us by law to sell this stock at cost to private owners, under certain restrictions approved by the Governor and Council. We will also have on hand more than the usual number of two-year seedlings ready for transplanting.

STOCK SHIPPED FOR PLANTING ON REFORESTATION LOTS.

NURSERY.	Species.	Class.	Number.
Amherst,	White pine,	3-year,	15,000
Amherst,	White pine,	4-year,	158,325
Amherst,	Red pine,	4-year,	44,000
Amherst,	Austrian pine,	4-year,	8,000
Amherst,	Norway spruce,	3-year,	10,000
Amherst,	Norway spruce,	4-year,	55,350
Amherst,	Scotch pine,	4-year,	9,000
Total,			299,675
Barnstable,	White pine,	4-year,	20,400
Barnstable,	Scotch pine,	4-year,	750
Barnstable,	Red pine,	4-year,	3,000
Barnstable,	Austrian pine,	4-year,	1,000
Barnstable,	Norway spruce,	4-year,	22,950
Total,			48,100
Grand total,			347,775

STOCK SHIPPED FOR PLANTING ON STATE FORESTS.

NURSERY.	Species.	Class.	Number.	State Forest.
Barnstable,	White pine,	4-year,	29,000	Myles Standish.
Barnstable,	White pine,	4-year,	7,000	Otter River.
Barnstable,	White pine,	4-year,	3,000	Harold Parker.
Barnstable,	Red pine,	4-year,	9,600	Myles Standish.
Barnstable,	Red pine,	4-year,	7,000	Otter River.
Barnstable,	Red pine,	4-year,	3,000	Harold Parker.
Barnstable,	Scotch pine,	4-year,	5,700	Myles Standish.
Barnstable,	Austrian pine,	3-year,	10,000	Myles Standish.
Barnstable,	Austrian pine,	4-year,	5,000	Myles Standish.
Barnstable,	Norway spruce,	4-year,	10,500	Myles Standish.
Barnstable,	Larch,	3-year,	11,000	Myles Standish.
Total,			100,800	
Myles Standish,	Scotch pine,	3-year,	10,000	Myles Standish.
Amherst,	White pine,	4-year,	15,000	Otter River.
Amherst,	White pine,	4-year,	16,000	Savoy.
Amherst,	Red pine,	4-year,	5,000	Otter River.
Amherst,	Larch,	2-year,	13,000	Otter River.
Amherst,	Norway spruce,	4-year,	6,000	Savoy.
Total,			55,000	
Grand total,			165,800	

STOCK SHIPPED TO SUBNURSERIES.

NURSERY.	Species.	Class.	Number.	Subnursery.
Barnstable,	White pine,	2-year,	25,000	Myles Standish.
Barnstable,	White pine,	2-year,	5,000	State Farm.
Barnstable,	White pine,	2-year,	25,000	Norfolk Hospital.
Barnstable,	Scotch pine,	2-year,	107,000	Myles Standish.
Barnstable,	Scotch pine,	2-year,	46,000	State Farm.
Barnstable,	Scotch pine,	3-year,	60,000	Myles Standish.
Barnstable,	Austrian pine,	2-year,	15,000	State Farm.
Barnstable,	Norway spruce,	2-year,	44,200	State Farm.
Total,			327,200	

STOCK SHIPPED OUTSIDE DEPARTMENT.

CONSIGNEE.	Address.	Species.	Class.	Number.	Nursery.
Barnard, J. H.,	Greenbush,	Hemlock,	4-year,	500	Amherst.
		White pine,	4-year,	1,500	Barnstable.
		Scotch pine,	4-year,	500	Barnstable.
		Red pine,	4-year,	500	Barnstable.
		Norway spruce,	4-year,	500	Barnstable.
Concord Water Board,	Concord,	White pine,	4-year,	1,500	Amherst.
		Red pine,	4-year,	1,500	Amherst.
		Norway spruce,	4-year,	500	Amherst.
Cushing, C. W.,	Lunenburg,	White pine,	4-year,	22,500	Amherst.
		White pine,	4-year,	5,000	Barnstable.
Fish and Game Commission,	Martha's Vineyard,	White pine,	4-year,	10,000	Barnstable.
		Austrian pine,	4-year,	5,000	Barnstable.
		Red pine,	4-year,	5,000	Barnstable.
Haskins, F. L.,	Norwell,	Assorted,	4-year,	2,100	Barnstable.
Gardner Colony,	Gardner,	White pine,	4-year,	3,000	Amherst.
		Norway spruce,	4-year,	3,000	Amherst.
Lutheran Home,	Avon,	White pine,	4-year,	1,000	Barnstable.
Massachusetts Agricultural College,	Amherst,	Assorted,	4-year,	500	Amherst.
McSweeney, E. F.,	Hudson,	White pine,	4-year,	2,000	Amherst.
Metropolitan Park Commission.	Blue Hills.	White pine.	2-year,	200,000	Amherst.

STOCK SHIPPED OUTSIDE DEPARTMENT — *Concluded.*

CONSIGNEE.	Address.	Species.	Class.	Number.	Nursery.
Metropolitan Water Board,	Fayville,	White pine,	2-year,	50,000	Barnstable.
Moth superintendent,	Bolton,	White pine,	4-year,	3,000	Amherst.
Moth superintendent,	Harvard,	White pine,	4-year,	3,000	Amherst.
Moth superintendent,	Hudson,	White pine,	4-year,	3,000	Amherst.
Norfolk Hospital,	East Norfolk,	White pine,	4-year,	6,000	Barnstable.
		Red pine,	4-year,	1,000	Barnstable.
		Norway spruce,	4-year,	500	Barnstable.
Parkhurst, C. W.,	Foxborough,	Norway spruce,	4-year,	2,000	Barnstable.
Park board,	Plymouth,	Assorted,	4-year,	1,000	Barnstable.
Park board,	Swampscott,	White pine,	4-year,	1,500	Barnstable.
		Scotch pine,	4-year,	500	Barnstable.
Peirce, E. R.,	Wellesley,	White pine,	4-year,	15,000	Amherst.
Smith School,	Northampton,	White pine,	4-year,	500	Amherst.
Spring, Russell,	Newton,	White pine,	4-year,	1,000	Amherst.
State sanatorium,	Westfield,	Red pine,	4-year,	500	Amherst.
		White pine,	4-year,	500	Amherst.
Water works,	Hudson,	White pine,	4-year,	13,000	Amherst.
		Larch,	4-year,	300	Amherst.
Water board,	Newburyport,	Norway spruce,	4-year,	5,000	Barnstable.

Totals for Amherst, 274,800; for Barnstable, 98,600; grand total, 373,400.

INVENTORY OF STOCK, STATE FOREST NURSERIES, 1917.

Barnstable.

SPECIES.	5-Year Transplants.	4-Year Transplants.	3-Year Transplants.	2-Year Seedlings (Beds).	1-Year Seedlings (Beds).
Red pine,	-	150,000	180,000	-	-
White pine,	20,000	200,000	350,000	225	150
Austrian pine,	-	10,000	-	-	-
Arbor vitæ,	-	25,000	-	-	-
Fir balsam,	-	15,000	-	-	-
Spruce,	3,000	50,000	-	58	20
Scotch pine,	-	-	-	40	-
Banks pine,	-	-	-	-	18
Larch,	-	-	-	6	-
Totals,	23,000	450,000	530,000	329	188

Amherst.

White pine,	-	833,000	166,000	195	160
Red pine,	-	23,000	2,000	18	-
Scotch pine,	-	62,500	192,000	-	72
Austrian pine,	-	-	25,000	-	-
Yellow pine,	-	-	42,000	-	-
Loblolly pine,	-	-	-	-	2
Banks pine,	-	-	-	-	5
Arbor vitæ,	-	4,000	-	-	-
Hemlock,	-	2,000	-	-	-
Norway spruce,	-	-	275,000	9	-
Totals,	-	924,500	702,000	222	239

Norfolk.

White pine,	-	25,000	25,000	-	-

Otter River.

White pine,	-	140,000	-	-	-

Myles Standish.

Scotch pine,	-	-	150,000	-	-
White pine,	-	-	25,000	-	-
Total,	-	-	175,000	-	-

INVENTORY OF STOCK, STATE FOREST NURSERIES, 1917 — *Concluded.*

State Farm.

SPECIES.	5-Year Transplants.	4-Year Transplants.	3-Year Transplants.	2-Year Seedlings (Beds).	1-Year Seedlings (Beds).
White pine,	-	-	50,000	-	-
Scotch pine,	-	760,000	27,000	-	-
Austrian pine,	-	3,700	12,000	-	-
Norway spruce,	-	-	40,000	-	-
Totals,	-	763,700	129,000	-	-
Grand totals,	23,000	2,300,000	1,560,000	550	427

STATE FOREST ADMINISTRATION.

Although the law puts the care and administration of the State forests in the hands of the State Forester, he has no appropriation for this purpose, so that by arrangement with the State Forest Commission such funds as the forestry branch can spare are expended on the Otter River State Forest, while the Commission uses some of its funds on the other State forests, — the Myles Standish, Harold Parker and Savoy Mountain.

Otter River State Forest. — During the past year we have reforested 60 acres of land and cleared of brush and small wood about 70 acres additional. The expenditure of $1,600 is only about one-half that of the previous year. Although there is very little valuable cordwood on this reservation, our men have been cutting gray birch fuel wood in order to aid in the local fuel supply. The present time is an excellent one in which to dispose of this wood, which under ordinary circumstances is not salable.

We have asked Mr. Haynes, engineer for the State Forest Commission, to give us a brief outline of the work done on the other State forests by the State Forest Commission under his supervision, and his statement here follows: —

Up to Nov. 30, 1917, there have been acquired by purchase by the State Forest Commission, under the Acts of 1914, chapter 720, approximately 11,000 acres of land comprising four separate State forests, as follows: —

1. The Otter River State Forest (1,700 acres), situated in the townships of Winchendon, Royalston and Templeton, in Worcester County.

2. The Myles Standish State Forest (7,000 acres), situated in the townships of Plymouth and Carver, in Plymouth County.

3. The Harold Parker State Forest (1,100 acres), situated in the townships of Andover, North Andover and North Reading, in Essex and Middlesex counties.

4. The Savoy State Forest (1,200 acres), situated in the township of Savoy, in Berkshire County.

These State forests are comprised to a considerable extent of waste land, and the act calling for its acquisition had for its main object the reclamation of waste land areas, *i.e.*, the gradual substitution of stands of forest trees of value to replace the worthless growth now covering a certain percentage of the area of all four forests. The State Forester is under the law given control and management of these tracts, and is charged with the responsibility of the proper prosecution of the necessary reclamation work that should be and must be done if the objects for which these tracts are being acquired are to be achieved and the values possible of being secured in the future are to become tangible. Owing to the fact that the State Forester has no fund available with which to prosecute the needed work to any material extent, it has again been necessary for the State Forest Commission to expend a portion of its funds during the past year in planting and protective and improvement work.

The State Forest Commission during the past year planted on the Myles Standish State Forest 232,000 plants, consisting of red, Scotch, Austrian and white pine, and Carolina poplar, to all of which plants the section is well adapted; also 102,000 seedlings were set in a nursery on the reservation, several miles of roads were cleared, fire equipment purchased, and a camp suitable for caring for twenty-five men was fitted up. On the Otter River State Forest the fire lines were replowed and some improvement work was done on the buildings on the reservation. On the Harold Parker State Forest and Savoy State Forest a total of about 30,000 pine and spruce transplants were set. With the exception of 40,000 poplars all of the transplants and seedlings were furnished from the nurseries of the State Forester. The plants in all cases have done well, and the percentage of those alive in the fall of 1917 will run over 95.

During the past three years there has been expended by the Commission on the State forests along such lines as planting, fire protection, equipment, and improvement work, approximately $8,560.

Expenditures for 1917 on State Forests.

In accordance with the provisions of section 3, chapter 720, Acts of 1914, the State Forester herewith gives a statement of the expenditures on each State forest for the past year.

Otter River State Forest.

Surveying,	$373 68
Planting,[1]	934 32
Brush cleaning,	788 58
House and miscellaneous expenses,	279 82
Nursery work,	111 00
Land purchase,	10 85
	$2,498 25

Savoy State Forest.

Line work,	$145 05
Planting,[1]	240 32
Land purchase,	6,051 59
	$6,436 96

Harold Parker State Forest.

Surveying,	$496 91
Planting,[1]	108 44
Land purchase,	291 12
	$896 47

Myles Standish State Forest.

Brushing,	$24 50
Surveying,	93 00
Fire lines and roads,	1,105 88
Planting,[1]	2,849 50
Nursery,	337 00
Miscellaneous account,	683 10
Land purchase,	35 45
	$5,128 43

FINANCIAL STATEMENT.

General Forestry and Nurseries.

Appropriation for 1917,		$20,850 00
Expenditures: —		
Salaries,	$8,412 76	
Travel,	2,777 20	
Printing,	433 03	
Stationery and postage,	45 46	
Maps, photos, etc.,	2 98	
Sundries,	573 06	
Supplies and equipment,	122 72	

---

[1] Figures on planting include price of trees furnished from the State Forester's nursery.

Nursery: —		
Pay roll,	$7,165 86	
Travel,	4 91	
Seeds and seedlings,	590 30	
Teams, freight and express,	330 68	
Equipment,	299 52	
Telephone and sundries,	90 45	
		$20,848 93
Balance returned to treasury Nov. 30, 1917,		$1 07

Purchase and Planting of Forest Lands.

Appropriation for 1917,		$10,000 00
Expenditures: —		
Pay roll,	$8,630 36	
Land,	182 50	
Travel,	303 39	
Express, freight and teams,	313 07	
Equipment,	488 44	
Postage,	20 00	
Printing,	18 20	
Sundries,	32 45	
		9,988 41
Balance returned to treasury Nov. 30, 1917,		$11 59

MOVING PICTURE REELS.

The three films owned by the department, each demonstrating different phases of our work, namely, (1) reforestation and nursery work, (2) forest fire work, and (3) suppressing gypsy moths, have been utilized for many special occasions during the year, both in Massachusetts and in exchange with other States. At the present time duplications are being made by the war department from these films for interesting our soldiers in the field in the work.

CREOSOTING GYPSY MOTH EGG CLUSTERS.

Year by year finds us perfecting our methods and always ready to try new methods. The fact that labor is scarce, and equipment and finances harder to get, makes us practice every economy possible. Realizing the high cost of spraying material, and that the coming season will test our every energy, the division moth men were called in to a conference, and we decided that a definite drive be made on curtailing every cent possible in the creosoting work this fall and winter, that the money thus saved might be used for spraying.

The creosoting of egg clusters is a proper remedy, and where judiciously done is very effective. The great trouble is that it may be overdone, as there is a danger of expending too much labor in this work. If one is depending solely upon creosoting to keep the gypsy moth in check he may be justified in a greater expenditure, but if, as is more commonly practiced, the trees are to be sprayed, the amount of creosoting necessary will depend entirely upon how bad the conditions are. The local moth superintendent should be able to advise on this matter. The practice of climbing trees and treating with creosote is largely eliminated, as the method is expensive. It should not be said dogmatically that this should never be done, however, for there are times when it is advisable. A good moth superintendent or forester must use his judgment at such times. Results are desired, but economy must be considered in getting them. Quick and effective so-called ground work, wherein the expense is kept low per acre, may be advisable, but the time-killing and painstaking practices of the past in tearing down stone walls and looking into every crevice with reflecting mirrors are out of date. Creosote, therefore, is only a means to an end, and better and more effective practice in suppression is spraying with arsenate of lead. Caterpillars are bound to eat, and poisoning them is sure to get effective results.

AUTO-TRUCK SPRAYERS.

The three new auto-truck sprayers that were built for this department proved, as was anticipated, to be great factors in our work the past season, enabling us to accomplish what otherwise would have been practically impossible. These sprayers were used almost entirely upon the highways and to supplant the horse-drawn sprayers that have been in use heretofore. In order to get the greatest amount of good out of them a regular route was outlined in advance for each outfit. A crew of three to accompany each, a mechanic and driver combined and two nozzle men, was selected, who remained with the machine throughout the spraying season. This crew was under direct charge of the division moth men while within their respective territories. The crew was provided with a camping outfit which was used provided other arrangements could not be easily planned for. Without explaining more in detail, the great advantages can readily be seen for the use of this equipment. The motor power for quick and effective work as compared to horse-drawn sprayers is self-evident. The auto truck requires but one man, an engineer and chauffeur combined, while a horse-drawn power sprayer requires two men, — an engineer and a driver. With the plans perfected for the work, water available and plenty of spraying material on hand a great amount of territory can be covered each day. The great drawback that must be encountered, however, is the inclement or rainy weather. The past season's plans were greatly interfered with, and the sprayers were unable to keep on schedule time for this reason. The United States government has four of these auto-truck sprayers in use, and are building three more. A photograph of one of our sprayers at work is shown in this report. The spraying attachments are easily removed, and the truck may be used for other purposes after the spraying season. Already a few cities and towns have truck sprayers. The question of their practicability and economy rests with the amount of work to be done, particularly the kind of work that requires a large amount of travel, like roadside spraying. Where this is not necessary a horse-drawn sprayer will do equally good work at less expense.

MOTH-THINNING WORK.

During the past year the division of this department, which originated the moth-thinning work, has finally so broadened as to embrace the whole field of forestry operations and forest utilization. When the work was started as a separate branch of the department, nearly five years ago, the need was for public education in the value of moth thinnings as a means of moth control, and for practical demonstration of the efficacy and financial success of these thinnings. That stage has now completely passed. Moth thinnings have come into almost universal practice throughout the infested region. They are paying for themselves in most cases, saving a large expenditure of money which would go in other means of moth control, and are bringing into use a considerable amount of forest material which would be wasted if not cut in thinnings.

A great opportunity is now before us. The years of patient education along forestry lines, added to the present unequaled demand for forest products of all kinds, have opened the minds of the woodland owner to the idea of conservation. Forestry along lumbering and utilization lines now has a chance to make good. The waste and desolation following the usual lumbering operations have brought about a reaction. The ravages of the gypsy moth and the chestnut blight, together with the potentialities of the pine blister rust, have made the forest owners wish to take account of stock and look toward the future. They want to operate conservatively, and to keep the forest land productive if they can see that it pays. It is our idea that if forestry does not pay 100 cents on a dollar plus interest, then it is no good. We know that it pays. We hope to take advantage of our opportunity and prove that it pays. Thus the moth-thinning work has developed into what might be called a forestry operating work. We are willing to co-operate with any person who wishes to cut his woodland conservatively, under practically the same terms as those under which the moth-thinning operations have been carried on; that is, the owner furnishes the capital and we supervise the operation and dispose of the product without charge except for traveling expenses.

During the past year, to help the moth-thinning branch of the department in its war and operating work, the forestry branch has undertaken to make practically all preliminary examinations, whether forestry or moth examinations. If the examinations developed so that further help or advice along operating or utilization lines was necessary, then the moth-thinning branch was called in. This management has resulted in a great saving of time and standardization of advice given. During the past year 22 new examinations covering 2,208 acres were made by the moth-thinning branch. Besides that about 40 examinations were made as called upon by the forestry branch.

A plantation of white pine on poorer or gravelly soils about rich bog lands, typifying the ideal conditions for cranberry bogs; hardwoods, the natural food of gypsy moths, replaced by pine, which is ten times as valuable and flourishes in light soils, — a solution of the moth trouble about cranberry bogs.

A typical example showing how young white pine trees may be utilized to fill in open and barren spaces in forests. These trees have been set out only three years, and are well established (Ashburnham).

REPORT OF DR. L. O. HOWARD, UNITED STATES ENTOMOLOGIST.

DEC. 19, 1917.

Prof. F. W. RANE, *State Forester, State House, Boston, Mass.*

DEAR PROFESSOR RANE: — I enclose a report on the parasite situation, which you are at liberty to use in your annual report.

Following my report to you of a year ago, I am now sending you a statement as to the conditions of the parasites which in earlier years have been imported under the joint effort of this Bureau and the State of Massachusetts in the effort to control the gypsy moth and the brown-tail moth. I have not had the opportunity during the past year to visit the parasite laboratory, except once in the early spring, and the paragraphs which follow are taken from a report on present conditions submitted to me by Mr. A. F. Burgess of this Bureau, in charge of the moth work.

The parasite work has been continued along similar lines as in the past few years. It has not been possible to introduce parasites from abroad owing to war conditions in Europe. Colonization of the parasites already introduced over the entire territory infested by the gypsy moth is being attempted, and several of the species are now established in practically all the infested area in Massachusetts.

The egg parasites, which spread much slower than some of the strong flying species, have been given special attention the past year as far as colonization is concerned.

Anastatus bifasciatus was colonized in 46 towns in Massachusetts during the spring of 1917, 1,722 colonies having been liberated. This species has become well established in most of the colonies previously placed in the field. Collections from colonies liberated in 1910 and 1911 have been examined, and the parasitism was found to range from 30 to 41 per cent.

Schedius kuvanæ was collected in a few places in Massachusetts in October and November, as most of the stock available this year was used in Maine and New Hampshire. Over 200,000 specimens were liberated, most of them being placed in woodland in Norfolk.

The parasitism by this species in old colonies has been gradually increasing during the last two years, and many collections this fall have shown that over 30 per cent. of the eggs were destroyed by this parasite.

Apanteles melanoscelus, the hymenopterous species which attacks the gypsy moth caterpillars, was found more abundant this year than heretofore, and it was possible to liberate several new colonies. Only a small number of individuals of this species were originally introduced, and considerable more work must be done in colonizing it throughout the infested region.

Compsilura concinnata was not as abundant generally as heretofore, although in some localities it caused very heavy inroads on the increase of the gypsy moth.

Blepharipa scutellata, a tachinid parasite which was introduced a number of years ago, and which has never been found in the field in large numbers, was recovered from several localities in eastern Massachusetts this year. From some of the collections of gypsy moth pupæ that were made a very high percentage of parasitism resulted, and it is hoped that this species will continue to increase.

The Calosoma beetle was slightly more effective this year than during the previous year. Extreme abundance of the species, however, was local rather than general. In some localities large numbers were present, and this resulted in the destruction of many gypsy moth caterpillars and pupæ.

The brown-tail moth was much less abundant this year then heretofore, and very few localities are known at the present time where the infestation is at all serious. Collections of webs were made during the winter and many caterpillars dissected. This work resulted in showing a very high percentage of parasitism. Breeding records during the spring and summer gave similar results.

Zygobothria nidicola was reared in large numbers from some of these collections, and this parasite was found over a much wider area than had been previously recorded.

The results of the work are encouraging, but the problem is complex and requires a large amount of investigation and study.

Yours most truly,
L. O. Howard,
Chief of Bureau.

Gypsy Moths and Co-operative Cranberry Work.

This work has continued as heretofore in the cranberry-growing sections of the State. The same method of State aid has been followed that is in vogue in general moth work. The town first expends its liability, and each bog owner is assessed for his individual liability. These funds are first spent before any reimbursement can be expected from the State. The understanding is that when any co-operative work is done about a bog, thereafter the bog is to be kept in condition by the owner without future assistance from the State. The cleaning of the shores about bogs is being quite universally practiced, and is of great assistance in keeping the crawling larvæ from reaching the bogs after they have stripped the surrounding woodlands. The spread of the very young larvæ by the wind is best overcome by spraying the vines with arsenate of lead. It has been reported by Mr. J. J. Walsh, the Wareham superintendent, that effective results against the moths were secured this year by flooding the bogs when the moths are in the pupa stage.

PASTE V. POWDERED ARSENATE OF LEAD.

The paste form of arsenate of lead is and has been the standard insecticide in our campaign against the gypsy moth for years. It has the proper spreading and adhesive qualities upon the foliage, mixes readily in water, and does not burn the foliage. This insecticide was the creation of the old Massachusetts moth department of the Board of Agriculture, and was given to the world unpatented. It is now probably the standard arsenical insecticide in use, even supplanting Paris green.

During recent years a new form of arsenate of lead has gradually come into use. This is the powdered, or dry, lead. At first, like nearly every new undertaking, this proved unsatisfactory, probably the greatest objection being its tendency to burn the leaves. It did not adhere to the foliage as well as the paste, and then, again, some trouble was experienced in keeping it sufficiently dry. A still further claim that the powdered form was much cheaper for the ingredients it contained did not prove true on analysis. This was, of course, a further consideration. The objectionable features of the dry lead, however, have gradually been done away with, and last season many of the cities and towns used more or less of it, and are planning to do so the coming season. One city forester is so well pleased with the dry form that he is using one-third dry to two-thirds paste next season.

The State Forester is in no way prejudiced in this matter, and only desires that in changing from a well-tested and satisfactory insecticide to a new one no mistakes are made. While we have not tested out all of the brands of dry arsenate, we are still convinced that there is much that should be known before recommending them for general use. This whole subject will be given more careful consideration and observation the coming season. Considering the bulkiness and extra expense of handling the 50 per cent. water in the paste lead, it is well worth determining whether we can use the dry lead to good advantage.

MEETING OF GYPSY MOTH OFFICIALS AT THE STATE HOUSE.

On March 15 a meeting of the gypsy moth officials of the State was held at the State House at the call of the State Forester, and it proved one of the largest gatherings of these men that has ever been assembled. Every phase of the moth work was discussed by various speakers. The convention was honored by an address by His Excellency, Lieutenant-Governor Calvin Coolidge. The State Forester reviewed the work of the year. Mr. Burgess and Mr. L. H. Worthley, representing the United States government, discussed the parasitic work and the methods of handling the spread of the moths. Prof. W. D. Clark of Amherst gave a talk on correspondence courses and their value to practical workers. Paul D. Kneeland spoke on the subject of moth-control methods by practical forestry utilization. Mr. J. G. Gordon of Lowell discussed methods of interesting property owners in the work. There was plenty of time for an open discussion which was general, and the day was well spent. The attendance was over 200.

MEETING OF TOWN OFFICIALS AND MOTH SUPERINTENDENTS AT BOURNE.

The moth officials of the whole Cape country, including also the towns of Plymouth, Carver, Middleborough, Lakeville and Marion, were called together in Bourne at the town hall on Wednesday, September 19. They were authorized to invite their selectmen and any other citizens likely to be interested to attend. The day was spent in the discussion of the whole moth question, with particular emphasis upon the district under consideration. Besides the State Forester, Mr. Walter F. Holmes, the new district moth superintendent, spoke relative to future plans; also Assistant Forester Paul D. Kneeland outlined the work in progress in forest thinnings and utilization of tree growth and its relation to moth work, and Mr. George Smith discussed the question of equipment for spraying. It is hoped that a better understanding of the aims and purposes of the work may have resulted as the outcome of this meeting. It is desired that the coming season may also result in more cooperation than ever. The State Forester certainly desires to render every possible service to this section the coming season.

SPECIAL MOTH WORK AT NANTUCKET.

During the past season the citizens of Nantucket and the summer people became very much exercised over the prevalence of insect pests on the island, particularly on their shade trees in the residential sections of the town. A tussock moth outbreak, the second within a few years, together with a gradual increase of the gypsy moth, due to slack methods of control, occurred last summer, threatening the tree life of the island. The presence of these hordes of caterpillars aroused the interest of the town in general, and, at an invitation extended by the board of selectmen and the Improvement Association, the State Forester made an investigation of conditions on the island and addressed a public meeting at which the chairman of the board of selectmen presided. Later a special town meeting was held, at which time a special appropriation was made, and the State Forester was asked to supervise the work. The appropriation was made at too late a date to do a great amount of work this fall; however, a thorough inspection of the trees was made by Mr. Smith and Mr. Fitzgerald of this department, and a few men were instructed to do the necessary creosoting of egg clusters. Plans were also perfected for additional spraying machinery for use next spring, and a beginning was made upon treating tree cavities, of which there are many needing attention.

Nantucket people are alive to the seriousness of the situation, and it remains for the State Forester to get results. He feels sure these can be accomplished through the splendid co-operation of the committee appointed to assist him. The work will be taken up again next spring and pushed vigorously to completion.

CHESTNUT BLIGHT.

There is nothing new to be said about this disease other than to emphasize what has already been stated. The disease is apparently as virulent as ever. When riding on the train from Boston to Pittsfield in August, a time when the conditions were just right to show its development, the woodlands exhibited a peppered condition of either dead or dying chestnut everywhere. The problem is one of utilization and rebuilding the forest stand with some other species. Much of the chestnut wood has been cut for poles, ties and cordwood during the year, and fortunately the markets have been good for handling it. Under ordinary times the cordwood would have been practically worthless.

THE STATE FIRE WARDEN'S REPORT.

Mr. F. W. RANE, *State Forester*.

SIR: — In compliance with your request, and in accord with the provisions of chapter 722, section 2, Acts of 1911, I beg to submit the following report of the work accomplished by this branch of the department this year.

The season of 1917 has been a comparatively favorable one from the standpoint of forest fire protection. The rainfall for the season was slightly above normal, and, with the exception of the months of July and November, was quite equally distributed throughout the year. During November the precipitation was 63/100 of an inch, the lowest record for this month in one hundred and five years, the drought lasting over a period of twenty-two days. In spite of favorable climatic conditions throughout the greater part of the season there has been an increase in the number of fires reported over the record of last year. However, through the efficient work of our observers, together with prompt co-operation on the part of the town and district forest wardens, we have experienced no disastrous fires, and the property damaged is slightly lower than that of a year ago.

Owing to the resignation on July 1 of Mr. Oscar L. Noyes of Byfield, Mass., district forest warden of the first district, the work in that district for the balance of the fiscal year has been carried on by the locomotive inspectors. It has seemed best in the interests of increased efficiency, without additional expense, to redistrict the State, adding one new district and making the division along county lines. In connection with the rearrangement of districts, and for the same reason of increased efficiency, a change has been made in the method of locomotive, portable sawmill and steam-roller inspection. Through an agreement with the Public Service Commission and the several railroads throughout the State we have received permission to assign the locomotive inspection work to the district forest wardens, who will examine locomotives operating in their respective territories and make report of such inspections to this department. It is believed that this will be an improvement over the former system under which two inspectors covered the entire State, for the reason that in addition to reducing the cost of inspection it will allow inspections to be made over the whole State in the early spring and in the fall, at which seasons it is essential that locomotives be in perfect condition if fires from this source are to be prevented. The inspection of portable sawmills and steam rollers will also be assumed by the district men. The new arrangement of districts is as follows: District No. 1 to include Essex and Middlesex counties, under the supervision of Mr. James E. Moloy, formerly locomotive inspector; District No. 2 to include Norfolk and Bristol counties, under the supervision of Mr. Miner E. Fenn, formerly locomotive inspector; District No. 3 to include Plymouth, Barnstable, Dukes and Nantucket counties, under the supervision of Mr. Joseph J. Shepherd, district forest warden; District No. 4 to include

Worcester and Franklin counties, under the supervision of Mr. John P. Crowe, district forest warden; District No. 5 to include Berkshire, Hampden and Hampshire counties, under the supervision of Mr. Albert R. Ordway, district forest warden.

The law relative to the disposal of slash and brush from wood and lumber cutting operations has been more rigidly enforced this year than in the past, with the result that many miles of slash along railroads and highways have been disposed of. Owing to the large number of woodcutting operations being carried on throughout the State this winter, we shall undoubtedly have more slash and brush left on the ground than in former years. This means an increased fire danger to contend with in many localities.

It is certainly very gratifying to note the large number of towns throughout the State that are using automobile equipment, either wholly or in part, for forest fire work. The tendency is certainly changing rapidly from the horse-drawn to the motor-driven apparatus. We have a large number of towns where the forest fire work is carried on by or in co-operation with the fire department, and in such cases the department combination truck is usually used for running to forest fires. For large or remote fires this is frequently supplemented by the older and slower horse-drawn wagon. The above conditions probably apply more generally to central and eastern Massachusetts than to the western part of the State.

Owing to favorable weather conditions during June, July and August we were able to discontinue fifteen of our stations for several weeks, and to use a number of the observers in the construction work and in painting the observation towers.

A considerable amount of construction work has been completed during the past year. A new tower 50 feet high has been erected on Martha's Vineyard, on land purchased from Capt. B. C. Cromwell adjoining the fish and game reservation in the central part of the island. This tower is equipped with stairs, and allows an unobstructed view of practically the entire island. The towns, together with several residents of the island, contributed very liberally towards the purchase of this tower.

A new 60-foot tower with stairs has been erected on Prospect Hill in Waltham. This station covers several thousand acres of very dangerous fire territory, where we have had some of the most damaging fires during the past four or five years. The cities of Waltham and Newton and the towns of Lexington and Wellesley contributed towards the purchase of this tower.

At Middleborough stairs have been installed in the tower in place of the ladder that has been in use there for some two or three years. The town of Middleborough appropriated $150 towards the purchase price of the stairs, and the work of construction was assumed by this department.

A new 50-foot tower with stairs has been erected on Little Mugget Hill, Charlton. This station will cover about 150,000 acres of forest lands. The several adjoining towns contributed towards the purchase price of the tower. Iron stairs were installed in our tower at Mendon.

A new 50-foot tower has been purchased for erection on Ragged Mountain in West Brookfield. Cement abutments have been constructed, but owing to insufficient funds it was found necessary to postpone the erection of the tower until another season. This will be done early this coming spring, when the station will be placed in operation.

The tower purchased last spring for Watatic Mountain has been erected during the past season and 2 miles of telephone line has been constructed. This is a 40-foot tower equipped with fire-escape stairs.

The efficiency of our Mount Tom station has been greatly increased by a new arrangement with the Holyoke Street Railway Company, whereby we are given the use of the cupola of the Summit House. Heretofore our observer has used the public observation room which, besides being some 40 feet lower than the cupola, is frequently crowded with visitors, making accurate work on the part of the observer more or less difficult. The new observation room has been equipped with the new regulation map, alidade and telephone.

Several of our towers were painted during the spring and early summer, and a considerable amount of work was done on roads leading to a number of them. A majority of our stations are now easily accessible to automobiles, and the number of visitors is consequently large.

It seems quite necessary that one more station be added to our system if we are to protect the valuable forest area in the towns of Acushnet, Rochester, Fairhaven, Marion and Mattapoisett. The desirable location for this station seems to be Mendall Hill in Acushnet, and if sufficient funds can be raised in the towns which would receive protection from such a station we shall probably erect a tower at this point.

We have recently arranged for the purchase of a site on Robbins Hill, Chelmsford, where we have maintained a small windmill type of tower for the past five years. This tower has proved very unsatisfactory both in design and elevation, and as soon as negotiations for the acquisition of land are completed, and sufficient funds have been contributed by the surrounding towns, we shall proceed with the erection of a large 75-foot tower to replace the one now in use. In spite of the defects mentioned above, this station has proved a valuable one, and with a standard tower giving 40 feet additional elevation it should become one of the best in the State.

TOWNS RECEIVING FIRE-EQUIPMENT REIMBURSEMENT DURING YEAR 1917.

Ashland,	$10 00
Avon,	13 42
Belchertown,	12 85
Bellingham,	4 63
Dunstable,	54 00
Georgetown,	53 52
Groveland,	62 75
Hampden,	5 49
Harwich,	15 00
Holbrook,	13 00
Lunenburg,	$89 63
Russell,	7 12
Savoy,	26 25
Southampton,	33 50
Southwick,	9 00
Sunderland,	24 00
Tolland,	25 00
Whately,	20 75
Total,	$479 91

Inventory of Equipment purchased under the Reimbursement Act.

Towns.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Acushnet, . .	1	10	18	–	–	–	4	1	–	–	–	2[1,3]	$250 00
Ashburnham, .	–	–	8	–	–	–	–	–	–	–	–	–	25 00
Ashby, . . .	–	–	48	–	–	–	2	2	–	6	–	1	250 00
Ashfield, . .	–	–	33	–	–	–	–	–	–	–	–	–	99 00
Ashland, . .	–	24	12	–	–	–	12	8	–	6	24	–	95 78
Auburn, . .	–	–	83	–	–	–	–	–	–	–	–	–	249 00
Avon, . . .	–	10	–	–	–	–	22	–	5	–	–	–	23 32
Becket, . . .	–	14	16	–	–	–	–	2	–	–	24	–	79 50
Bedford, . .	1	14	24	–	–	–	–	–	–	–	–	1[3]	249 67
Belchertown, .	–	–	46	12	–	–	–	1	–	12	–	1[1]	224 72
Bellingham, . .	–	46	27	–	–	–	6	–	–	8	24	1[1]	151 40
Berkley, . .	–	36	24	–	–	–	–	–	–	–	–	–	162 00
Berlin, . . .	2	10	38	–	–	1	12	–	3	12	–	1[1]	241 45
Blandford, . .	6	1	16	–	–	–	3	3	–	–	12	–	83 17
Bolton, . . .	–	14	33	–	–	–	6	–	–	6	–	–	126 65
Boxborough, .	1	12	30	–	–	2	–	–	3	4	3	1[1]	182 80
Boxford, . .	–	24	16	–	–	–	–	–	–	–	12	–	51 75
Boylston, . .	–	–	66	–	–	–	24	–	–	28	–	–	243 61
Brimfield, . .	–	10	48	–	–	–	–	–	–	–	–	–	170 25
Brookfield, . .	–	66	25	–	–	–	–	3	–	24	24	–	127 00
Burlington, . .	–	–	20	–	–	–	–	–	–	–	–	–	100 00
Carlisle, . .	2	15	19	–	2	–	6	–	1	6	12	1[2]	250 00
Charlton, . .	–	–	77	–	–	–	4	–	–	6	–	–	250 00
Chatham, . .	2	5	11	–	2	3	4	–	3	5	–	1[1]	152 98
Chester, . .	–	37	15	–	–	–	–	5	–	–	12	1[1]	156 97
Chesterfield, .	–	–	25	–	–	–	–	–	–	–	–	–	75 00
Colrain, . .	–	–	10	–	–	–	–	–	–	–	12	–	43 75
Cummington, .	–	–	19	–	–	–	–	–	–	–	–	–	102 12
Dana, . . .	–	–	6	–	–	–	–	–	–	–	–	1[3]	250 00
Dighton, . .	5	8	26	–	1	–	–	–	5	2	30	2[1]	242 89
Douglas, . .	–	75	50	–	–	–	–	–	–	–	–	–	180 25
Dunstable, . .	2	25	22	–	1	–	4	–	3	6	6	1[1]	164 69
East Longmeadow,	2	–	18	–	2	–	12	3	–	4	–	1[1]	164 46
Edgartown, . .	2	5	10	–	2	3	4	–	3	5	–	1[1]	152 17
Enfield, . .	–	20	27	–	–	–	–	–	–	–	–	–	85 87

[1] One-horse. [2] Two-horse. [3] Motor truck.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT — *Continued.*

TOWNS.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Erving,	-	-	27	6	-	-	-	-	-	18	-	-	$94 52
Essex,	-	24	12	-	-	-	-	-	-	-	-	-	37 80
Florida,	-	-	8	-	1	-	5	1	-	-	-	-	31 25
Freetown,	-	24	20	-	-	-	-	2	-	72	-	-	167 48
Georgetown,	-	54	66	-	-	-	-	-	6	24	-	-	250 00
Gill,	-	5	20	-	-	-	-	-	-	-	-	-	65 00
Goshen,	-	12	58	-	-	-	-	-	-	-	-	-	244 05
Gosnold,	-	8	12	-	-	-	-	-	-	-	-	-	55 40
Granby,	-	12	12	-	-	-	-	-	-	-	-	-	39 90
Granville,	-	10	22	-	-	-	-	-	-	-	-	2^1	203 50
Greenwich,	-	-	18	-	-	-	-	-	-	-	-	-	60 45
Groveland,	-	18	22	-	-	-	-	-	5	24	12	-	113 80
Hadley,	-	-	15	-	-	-	-	-	-	-	-	-	75 00
Halifax,	-	12	64	-	-	-	12	-	-	18	-	1^1	241 91
Hampden,	-	-	24	1	-	-	24	-	6	6	18	-	94 55
Hancock,	-	9	-	-	-	-	-	2	-	-	6	-	14 37
Hanson,	-	6	24	-	-	-	6	-	-	5	-	2^{1,3}	250 00
Harvard,	2	7	29	-	2	3	-	-	3	12	-	1^2	250 00
Harwich,	-	-	14	-	-	-	-	2	-	-	-	2	79 50
Holbrook,	-	12	31	-	-	-	-	7	-	-	48	-	208 25
Holland,	-	-	8	-	-	-	-	-	-	-	-	-	25 00
Hubbardston,	-	-	52	-	-	-	18	-	-	4	-	-	175 75
Kingston,	-	-	24	-	-	-	-	-	-	-	-	2^1	108 00
Lakeville,	-	20	17	-	-	-	-	-	-	-	-	-	80 00
Lanesborough,	2	5	8	-	3	-	-	3	6	6	48	1^1	131 50
Leverett,	2	20	16	8	2	4	-	2	4	8	-	2^1	160 17
Leyden,	16	10	10	17	-	-	-	-	4	8	-	-	31 55
Littleton,	-	-	6	-	-	-	-	-	-	18	-	-	34 87
Lunenburg,	2	36	30	-	2	3	4	-	3	29	-	1^1	250 00
Lynnfield,	-	35	20	-	-	-	-	10	-	-	6	2^1	249 95
Mashpee,	6	24	25	-	-	-	12	-	-	12	-	1^1	157 12
Mendon,	-	24	21	-	-	-	-	-	-	-	42	1^1	173 97
Merrimac,	-	-	15	-	-	-	-	-	-	-	-	-	75 00
Middleton,	-	12	16	6	2	-	-	-	-	5	-	-	157 69

[1] One-horse. [2] Two-horse. [3] Motor truck.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT — *Continued.*

TOWNS.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Millis,	–	–	8	–	–	–	–	–	–	–	–	1[2]	$242 00
Monterey,	–	–	–	–	–	–	–	3	–	–	12	–	15 25
Montgomery,	–	–	–	–	–	–	–	4	–	–	–	–	17 00
New Ashford,	–	–	–	–	–	–	–	4	–	–	4	–	18 25
New Braintree,	–	–	37	–	–	–	–	–	–	–	6	–	122 85
New Salem,	–	55	20	–	–	–	–	–	–	–	–	–	100 50
Newbury,	–	–	6	–	–	–	–	8	–	–	12	–	55 90
Norfolk,	–	–	18	–	–	–	–	–	–	–	–	–	99 00
North Reading,	–	–	38	–	–	–	–	–	–	–	12	1[1]	250 00
Northborough,	–	–	25	–	–	–	–	–	–	–	–	–	102 37
Norton,	–	2	8	–	–	–	–	–	–	12	12	1	241 25
Norwell,	6	–	32	–	–	–	12	–	–	12	–	1[1]	250 00
Oakham,	–	12	31	–	1	1	6	–	3	3	–	1[1]	226 97
Otis,	–	5	10	–	–	–	–	1	–	–	–	–	66 75
Paxton,	3	–	28	12	–	–	–	–	–	6	–	–	105 87
Pelham,	–	–	19	–	–	–	–	5	–	–	–	–	84 12
Pembroke,	–	–	31	–	–	–	60	–	–	–	–	1[2]	250 00
Petersham,	2	10	36	–	2	3	4	–	3	5	–	1[1]	248 05
Phillipston,	–	36	38	–	–	–	–	1	–	–	–	–	130 15
Plainfield,	–	–	30	–	–	–	–	–	–	–	–	–	146 25
Plainville,	2	10	22	–	2	3	4	–	3	5	30	1[1]	228 75
Plympton,	–	–	–	–	–	–	–	12	–	18	–	–	25 66
Prescott,	–	100	10	–	–	–	–	–	–	–	–	–	58 03
Princeton,	–	32	30	–	–	–	–	–	–	–	–	–	249 20
Raynham,	3	46	30	–	6	3	12	–	9	15	–	3[1]	222 23
Rehoboth,	–	10	48	–	–	–	–	–	–	–	–	1[1]	250 00
Richmond,	–	15	31	–	–	–	4	–	–	12	–	–	109 20
Rochester,	–	24	60	–	–	–	–	–	–	30	–	–	205 37
Royalston,	3	20	32	30	2	2	12	–	–	42	–	2[1]	250 00
Russell,	–	10	39	–	–	–	–	1	–	4	12	1[1]	227 37
Rutland,	–	12	18	–	–	–	6	–	–	–	–	1[3]	250 00
Salisbury,	6	–	47	–	10	–	29	–	–	11	–	–	250 00
Sandwich,	22	12	36	–	–	2	–	–	–	24	–	1[1]	245 60
Savoy,	–	–	–	–	–	–	–	5	–	–	–	–	26 25

[1] One-horse.

[2] Two-horse.

[3] Motor truck.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT — *Concluded.*

TOWNS.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Shelburne,	-	-	50	-	-	-	-	5	12	6	-	1	$186 87
Shirley,	-	48	42	-	-	-	-	-	-	-	-	-	166 50
Shutesbury,	-	28	25	-	-	-	23	-	-	6	-	-	101 25
Southampton,	-	10	-	-	-	-	-	5	-	-	12	-	42 25
Southwick,	-	13	26	12	-	-	3	2	-	24	-	1[1]	131 07
Sterling,	-	-	25	-	-	-	-	-	-	-	18	1[2]	241 12
Stow,	-	-	42	-	-	-	-	-	-	18	-	-	131 31
Southbridge,	-	11	35	-	-	-	-	-	-	-	-	-	116 45
Sudbury,	-	-	40	-	-	-	-	-	-	-	-	-	250 00
Sunderland,	-	-	-	-	-	-	-	-	-	-	-	4	24 00
Sutton,	-	50	50	24	-	-	-	-	32	24	-	1	188 46
Tewksbury,	2	-	24	-	2	-	-	-	-	30	-	1[1]	174 00
Tolland,	2	-	-	12	6	-	12	6	-	-	4	-	43 26
Townsend,	-	-	46	-	-	-	-	-	-	-	-	-	250 00
Tyngsborough,	-	220	20	-	-	-	-	54	12	24	36	-	250 00
Tyringham,	2	10	30	-	2	-	10	-	2	3	-	1[2]	144 80
Upton,	1	18	30	-	-	-	-	-	-	-	24	1[1]	240 23
Wales,	2	-	40	12	2	2	2	-	-	6	-	1[1]	241 99
Warwick,	-	6	10	-	-	-	-	-	-	-	-	1[1]	154 35
Washington,	-	-	15	3	1	-	10	-	-	8	-	1[1]	105 32
Wendell,	-	38	27	-	2	-	12	-	-	18	-	1[1]	163 24
West Boylston,	-	-	107	-	-	-	-	-	-	-	-	-	250 00
West Bridgewater,	-	-	20	-	-	-	-	-	-	-	-	1[1]	250 00
West Brookfield,	-	16	49	-	-	-	-	7	-	12	24	-	221 50
West Newbury,	-	8	13	-	-	-	-	3	-	-	18	-	87 12
Westhampton,	-	-	16	-	-	-	-	-	-	-	-	-	48 00
Westminster,	-	77	48	24	-	-	24	1	-	36	12	-	250 00
Whately,	-	-	-	-	-	-	-	4	-	-	12	-	20 75
Wilbraham,	-	27	32	-	-	-	23	4	12	6	12	-	118 38
Wilmington,	-	12	40	-	1	-	-	18	-	34	-	-	187 38
Windsor,	-	-	60	-	-	-	-	-	-	-	-	-	250 00
Worthington,	2	15	10	-	-	3	-	-	-	5	-	1[1]	86 01
Wrentham,	-	12	30	-	-	4	-	-	-	-	-	1[1]	250 00
Totals,	114	1,910	3,602	179	61	42	474	210	151	868	647	70	$20,575 32

---

[1] One-horse.

[2] Two-horse.

FOREST FIRES OF 1917.

MONTHS.	Number.	Acres.	Cost to extinguish.	Damage.
1916.				
December,	16	200	$102	$10
1917.				
January,	53	243	300	35
February,	14	35	-	47
March,	126	379	420	85
April,	824	7,516	5,819	12,639
May,	518	7,283	6,068	16,088
June,	56	406	469	630
July,	46	119	171	2,145
August,	65	294	1,308	3,675
September,	23	29	223	65
October,	20	39	237	50
November,	414	3,477	2,916	5,640
Totals,	2,175	20,020	$18,033	$41,109

CLASSIFIED CAUSES OF FOREST FIRES FOR THE PAST FIVE YEARS.

CAUSES.	1912.		1913.		1914.		1915.		1916.		1917.	
	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.
Unknown,	649	35.1	650	24.2	1,174	37.0	1,134	37.7	301	30.8	634	29.2
Railroad,	640	34.6	913	34.0	830	36.0	777	25.8	412	42.1	800	36.8
Burning brush,	93	5.0	148	5.5	196	6.2	439	14.5	79	8.1	262	12.0
Hunters (smokers),	223	12.0	386	14.3	520	16.4	129	4.2	111	11.3	224	10.3
Steam sawmills,	8	.4	6	.2	3	.1	5	.1	2	.2	5	.2
Children,	79	4.3	100	4.1	140	4.4	161	5.3	35	3.6	133	6.1
Miscellaneous,	159	8.6	476	17.7	318	9.9	363	12.4	38	3.9	117	5.4
Totals,	1,851	100.0	2,688	100.0	3,181	100.0	3,008	100.0	978	100.0	2,175	100.0

TYPES OF LAND BURNED OVER (ACRES).

	1914.	1915.	1916.	1917.
Timber,	3,001	3,817	1,435	1,237
Second growth,	9,016	6,749	755	2,274
Second growth, not merchantable,	7,943	9,107	1,970	4,137
Brush land,	11,645	14,681	9,990	7,126
Grass land,	3,510	8,129	1,573	3,814
Not classified,	4,860	5,907	475	1,432
Totals,	38,975	48,389	16,198	20,020

TYPES OF CLASSIFIED DAMAGES.

	1914.	1915.	1916.	1917.
Standing trees,	$50,697	$73,782	$18,786	$24,705
Logs, lumber, cordwood,	4,427	23,544	4,545	4,680
Buildings, bogs, etc.,	3,530	31,904	10,823	6,893
Bridges, fences,	331	1,930	1,638	687
Not classified,	26,404	9,907	8,973	4,144
Totals,	$95,389	$141,073	$44,765	$41,109

COMPARATIVE DAMAGES BY FOREST FIRES FOR THE PAST EIGHT YEARS.

YEAR.	Number of Fires.	Acreage burned.	Cost to extinguish.	Damage.	Average Acreage per Fire.	Average Damage per Fire.
1910,	1,385	42,221	$23,475	$205,383	30.46	$148 29
1911,	2,356	99,693	47,093	537,749	39.31	228 24
1912,	1,851	22,072	20,219	80,834	11.92	43 67
1913,	2,688	53,826	35,456	178,357	20.02	66 35
1914,	3,181	38,975	43,750	95,389	12.25	29 98
1915,	3,008	48,389	36,783	141,073	16.08	46 90
1916,	1,225	16,198	8,593	44,765	13.22	36 54
1917,	2,175	20,020	18,033	41,109	9.21	18 90

FIRES REPORTED FROM OBSERVATION STATIONS.

[The asterisk (*) signifies station not in operation.]

No.	STATIONS.	1914.	1915.	1916.	1917.
1	Harwich station,	35	31	20	22
2	Barnstable station,	14	42	7	10
3	Falmouth station,	1	13	9	7
4	Bourne station,	54	114	28	18
5	Kingston station,	116	102	25	36
6	Waltham station,	*	*	*	2
7	Middleborough station,	133	128	61	25
8	Fall River station,	33	453	222	151
9	Rehoboth station,	105	101	148	79
10	Hanson station,	68	167	68	39
11	Hingham station,	*	*	*	24
12	Sharon station,	203	280	42	72
13	Sudbury station,	*	98	97	77
14	Wakefield station,	174	263	40	35
15	Chelmsford station,	302	276	29	71
16	Georgetown station,	*	213	26	30
17	Manchester station,	96	272	3	4
18	Mendon station,	*	*	65	63
19	Westborough station,	386	530	74	74
20	Wachusett station,	485	598	121	184
21	Petersham station,	*	*	*	*
22	Watatic station,	*	*	*	*
23	Warwick station,	94	36	38	37
24	Pelham station,	47	59	15	24
25	Brimfield station,	90	86	30	41
26	Charlton station,	*	*	*	*
27	Mount Tom station,	135	72	*	37
28	Shelburne Falls station,	130	104	38	34
29	Savoy station,	11	13	1	5
30	West Brookfield station,	*	*	*	*
31	Chester station,	*	*	2	1
32	Tolland station,	*	*	13	14
33	Mount Everett station,	*	3	32	22
34	Lenox station,	*	*	11	21
35	Williamstown station,	*	56	8	–
36	Martha's Vineyard station,	*	*	*	–

PRECIPITATION IN INCHES FROM 1911 TO 1917, INCLUSIVE.

	1911.	1912.	1913.	1914.	1915.	1916.	1917.	Normal.
December,	3.24	2.59	5.73	3.66	4.56	5.69	3.71	3.74
January,	3.07	3.87	3.21	4.30	7.38	1.84	3.32	4.12
February,	3.20	2.24	3.77	3.52	4.30	5.37	3.15	3.97
March,	3.27	5.26	5.32	4.20	.06	4.16	5.03	4.34
April,	2.86	4.05	4.73	5.51	2.44	5.43	3.18	3.46
May,	.89	4.03	2.85	2.95	2.01	3.97	5.86	3.37
June,	4.76	.53	3.20	1.75	1.48	5.31	4.77	3.07
July,	4.55	4.16	2.00	3.38	9.52	7.55	.85	3.65
August,	6.70	3.85	3.30	4.59	4.83	2.81	8.58	3.70
September,	3.36	1.71	2.77	.45	.74	1.66	3.17	4.36
October,	3.01	1.52	7.62	2.03	3.11	1.81	6.88	4.13
November,	5.71	3.45	2.70	3.06	2.47	1.88	.63	3.96
Totals,	44.62	37.26	47.20	39.40	42.85	47.48	49.13	45.87

APPROPRIATION FOR PREVENTION OF FOREST FIRES.

Appropriation for 1917,	$28,000 00
Receipts: —	
For equipment from towns and cities,	1,899 41
For fire towers: —	
Auburn,	100 00
Bridgewater,	100 00
Charlton,	100 00
Douglas,	100 00
Dudley,	100 00
Edgartown,	200 00
Groton,	100 00
Lexington,	200 00
Middleborough,	150 00
Millbury,	100 00
Newton,	200 00
Oxford,	100 00
Scituate,	150 00
Southbridge,	100 00
Spencer,	100 00
Sturbridge,	100 00
Sutton,	100 00
Tisbury,	200 00
Uxbridge,	75 00
Waltham,	300 00
Wellesley,	200 00
Mr. and Mrs. Edmund Bridge,	25 00
Mr. William M. Butler,	25 00
Mr. Francis A. Foster,	25 00
Seven Gates Farm,	25 00

Adams Express Company,	$6 00
Boston & Albany Railroad,	14 92
Boston & Maine Railroad,	22 32
New York, New Haven & Hartford Railroad,	6 74
Paul D. Kneeland,	52 00
New England Telephone and Telegraph Company,	4 61
Mill units to England,	381 59
New Hampshire,	80 00
Rhode Island,	8 00
Rebate on salary increase,	227 52
	$33,678 11
Expenditures: —	
Pay roll,	$16,267 72
Traveling expenses,	4,895 75
Printing,	793 02
Stationery and postage,	132 87
Sundries,	94 76
Equipment,	1,704 60
Construction,	5,597 59
Teams, freight and express,	225 94
Telephone,	737 83
Supplies,	5 80
Town supplies,	2,770 05
Truck expenses,	321 22
Rent,	130 00
	$33,677 15
Balance returned to treasury,	96
	$33,678 11
Reimbursement for forest fire-fighting equipment to towns,	$479 91

Railroad Fires.

Our reports on file show that we have had 800 railroad fires, as follows: Boston & Albany, 227; Boston & Maine, 129; New York, New Haven & Hartford, 398; and Central Vermont, 46. These fires burned over an area of 7,950 acres, with a damage of $13,185 and cost to extinguish of $5,800.

The number of railroad fires has increased considerably over last year. The railroad officials claim that this is due in a measure to defective coal that they have been obliged to use this season. This is undoubtedly true in many instances, but just what percentage of these fires was due to this cause I am unable to state. Our inspectors' reports of locomotives examined by them show many minor defects, but very few serious defects on locomotives that were used entirely within the State.

Owing to the shortage of labor and the high wages paid in practically all industries throughout the State, many towns have experienced considerable difficulty in securing men for fighting forest fires. This is especially true in the case of railroad fires, as the railroads are at present paying only 25 cents per hour for this work. It seems very evident that

This photograph was taken in the 80-acre plantation on Nantucket. It represents a growth of 29 inches the past season. These trees were four-year-old white pine transplants when set, and the whole plantation thus far is a pronounced success. The average growth of the plantation this season is over 8 inches. Two-year-old Scotch pine seedlings set at the same time have not done as well. This experiment is in co-operation with the Nantucket Civic League.

This photograph was taken in September, and shows dry dead grass standing along a trolley line. Is there any wonder that forest fires develop here? Never-go-out matches, cigarette and cigar stubs are constantly being thrown from electric cars. Here are ideal conditions for a conflagration, and it is almost a miracle if fires do not result. In fact, they do, and this country is a barren waste on account of repeated fires.

this rate must be increased to at least 35 or 40 cents per hour for laborers, and 50 cents per hour for wardens, if we are to secure the labor necessary for handling this class of fires in the future.

During the past years we have had considerable trouble with the Central Vermont locomotives, owing to the terminals being in Vermont and Connecticut, but this season the Massachusetts Public Service Commission has required that a report be filed with them each month showing the actual condition of the front ends and ash pans of the locomotives running through this State. Our inspectors have inspected 1,249 locomotives, as follows: Boston & Albany, 167, of which 63 were defective; Boston & Maine, 346, of which 34 were defective; New York, New Haven & Hartford, 736, of which 211 were defective.

The following reports from Mr. E. A. Ryder, commissioner of the Boston & Maine Railroad, and Mr. Charles B. Rood, general fire claim agent of the New York, New Haven & Hartford Railroad, will give you a general idea of what these roads have done during the past year relative to fire protection.

BOSTON, MASS., Dec. 14, 1917.

MR. M. C. HUTCHINS, *State Fire Warden, State House, Boston, Mass.*

DEAR SIR: — Acknowledging your letter of the 5th instant, relative to report covering fire prevention work for the current year, we beg to state that during the eleven months we have had 940 fires from sparks from locomotives.

During November we had 272 fires, which is the greatest number we have had in that month since taking hold of this work in 1912.

Practically all of this year our section crews have been lacking the usual number of men, so that it has been difficult to attempt more than the necessary track work; and in some cases we could not even man our patrol cars. This of course delayed and in many cases prevented the cutting of the grass and burning the right of way. It should also be borne in mind that in many places the hay crop was not harvested, so that the rain during the first three weeks of October so matted the grass that it left "comfy" places for sparks; and to make matters worse, we had neither rain nor snow the first twenty days of the month, but did have almost daily high winds, — a very unusual condition.

For the eleven months we have paid, in fire claims, $20,045.40, and for outside help in fighting fires, $1,652.03, compared with $35,884.51 and $4,335.64, respectively, for 1916.

During the period we have received forty-two permissions to burn grass and slash on property contiguous to our right of way, and we have written many individuals and firms requesting that they remove fire hazards.

Six hundred and twenty-one locomotives reported as setting fires have received special examination.

Yours truly,

E. A. RYDER,
Commissioner.

BOSTON, MASS., Dec. 21, 1917.

MR. M. C. HUTCHINS, *State Fire Warden, State House, Boston, Mass.*

DEAR SIR: — Complying with your request of Dec. 5, 1917, relative to the activities of this department in cleaning up right of way, etc., beg to advise that during the past year, commencing Jan. 1, 1917, we have cleared up approximately 500 miles of right of way and adjacent property, cutting the underbrush and trimming trees for fire protection, at a total cost of $6,132.49. Practically the entire length of right of way in the State of Massachusetts has been burned over, with the exception of certain places where it has been too damp to burn up to the present time. This is also true of many parcels adjoining our right of way where permits to burn could be obtained, and where it was not necessary to cut any brush or undergrowth.

Since Jan. 1, 1917, up to and including this date, we have received 121 claims from property owners in the State of Massachusetts, of which 84 claims have been settled for a total of $9,775.59, leaving a balance of 37 unsettled claims, all of which, however, are for slight damages.

We have paid $338.77 to various towns in the State of Massachusetts for services in extinguishing fires during the above period, of which amount $182.11 was paid to towns on the Cape.

Regarding the matter of patrol work, would say that it has long been our custom, during the dry seasons each year, to place patrolmen on practically every dangerous section of the line, whose duty it is to follow up all trains as closely as possible and watch for fires.

Yours very truly,
C. B. Rood,
General Fire Claim Agent.

Federal Co-operation.

We have maintained the same co-operative arrangement with the United States Forest Service this year as in former years, the allotment allowed the Commonwealth of Massachusetts being $2,752 for payment of observers, and $500 for construction work. As the regulations governing the Federal allotment required that the observers and men on construction work be paid direct by the Federal department, it was necessary to transfer nine observers to the Federal pay roll for the entire season, and five men for a period covering the time the construction appropriation lasted. The aid received from the Federal department has certainly been of great assistance to this department, allowing us to expend a portion of our State appropriation for the construction of observation towers. Our allotment for the coming season will undoubtedly remain the same, with the exception of the construction appropriation.

During the season Mr. Louis S. Murphy, acting chief of State Co-operation of the Federal Forest Service, visited several of the Massachusetts stations maintained by that department.

. . . .

Of the $2,000 appropriated by the General Court for reimbursing towns with a valuation of $1,750,000 or less, 50 per cent. on forest fire-fighting equipment purchased by them and approved by this department, but $479.91 has been expended. This is the lowest expenditure from this appropriation in several years, and is probably due to the favorable fire season and also to the fact that many of the reimbursement towns have already taken up their entire allotment.

Respectfully submitted,
M. C. Hutchins,
State Fire Warden.

STATE HIGHWAY WORK.

Along the State highways spraying and cleaning for the gypsy and brown-tail moths and the elm-leaf beetle were done under the direction of this department. A list of the towns and cities in which the work was done may be found in the report of the State Highway Commission. The expenditure amounted to $10,000.

CO-OPERATIVE MOTH WORK.

Co-operative moth work has been carried on this past year as heretofore on the North Shore. Spraying was done in Dover last year, but very little other co-operative work has been done. The financial condition of the funds is as follows: —

Special North Shore Fund.

Balance Nov. 30, 1916,	$3,381 46	
Receipts: —		
Wm. D. Sohier, agent for property owners,	2,456 64	
F. W. Rane, State Forester,	6,000 00	
Wm. D. Sohier, agent,	6,000 00	
City of Beverly,	3,000 00	
Town of Manchester,	3,000 00	
Massachusetts Highway Commission,	631 70	
Massachusetts Highway Commission (mosquito work),	346 71	
Sale of truck,	200 00	
Sale of water carts,	300 00	
Sale of empty barrels,	16 10	
Appropriation for suppression of gypsy and brown-tail moths,	1,701 42	
Wm. D. Sohier, for property owners,	1,961 70	
Wm. D. Sohier, agent,	1,000 00	
F. W. Rane, State Forester,	1,000 00	
		$30,995 73
Expenditures: —		
Pay roll,	$15,832 09	
Travel,	729 89	
Supplies,	11,301 03	
Sundries,	1,222 35	
Rent of store,	375 00	
		29,460 36
Balance, Nov. 30, 1917,		$1,535 37

Dover Gypsy Moth Fund.

Balance, Nov. 30, 1916,	$471 35	
Receipts: —		
For wood sold,	334 88	
For spraying,	1,383 45	
		$2,189 68
Expenditures: —		
Pay roll,	$96 59	
Supplies,	1,971 45	
Sundries,	13 00	
		2,081 04
Balance, Nov. 30, 1917,		$108 64

Sagamore Gypsy Moth Fund.

Balance, Nov. 30, 1916,	$329 73
Receipts: —	
Spraying (1916),	243 85
Balance, Nov. 30, 1917,	$573 58

FINANCIAL STATEMENT.

Office Salaries.

Appropriation for 1917,	$6,900 00
Expenditures,	6,291 50
Balance returned to treasury Nov. 30, 1917,	$608 50

Office Incidentals.

Appropriation for 1917,		$5,100 00
Expenditures: —		
Travel,	$1,506 98	
Printing,	826 40	
Stationery and postage,	1,390 37	
Supplies,	100 70	
Maps, photos, etc.,	290 88	
Educational work,	58 74	
Sundries,	400 10	
		4,574 17
Balance returned to treasury Nov. 30, 1917,		$525 83

The Distribution of Supplies.

The following is a list of cities and towns, with amount of supplies for moth work furnished them, for the year ending Nov. 30, 1917. The amounts given are the gross amounts furnished, some of the cities and towns having made payments to the State Forester's office for all or a part of the amounts, according to their net expenditures or their class under the provisions of the law. For amounts received from this office in reimbursement and supplies see the table on page 73.

List of Cities and Towns and Amounts of Supplies furnished for 1917.

Acton,	$861 35	Eastham,	$3 73
Andover,	1,586 70	Easthampton,	40 75
Arlington,	632 50	Essex,	254 44
Ashburnham,	362 76	Foxborough,	163 00
Ashby,	426 94	Franklin,	81 50
Ashland,	508 19	Gardner,	97 80
Attleboro,	97 80	Georgetown,	648 54
Auburn,	84 90	Gloucester,	446 62
Avon,	124 45	Grafton,	4 23
Ayer,	340 27	Groton,	913 68
Barnstable,	6 32	Groveland,	1,082 96[1]
Bedford,	1,139 23	Halifax,	250 10
Berkley,	488 93[1]	Hamilton,	986 96
Berlin,	489 37	Hanover,	918 74
Beverly,	545 55	Hanson,	304 06
Billerica,	1,398 26	Harvard,	1,054 19
Bolton,	753 97	Harwich,	254 13
Boxborough,	692 97	Hingham,	1,422 00
Boxford,	731 06	Holbrook,	265 29
Boylston,	66 17	Holden,	195 46
Brewster,	78	Holliston,	156 35
Bridgewater,	612 76	Hopkinton,	142 06
Burlington,	614 99	Hudson,	562 80
Cambridge,	308 10	Ipswich,	1,134 02
Canton,	2,295 95	Kingston,	12 36
Carlisle,	586 26	Lakeville,	199 95
Carver,	275 27	Lancaster,	203 75
Chelmsford,	1,384 67	Lexington,	1,805 03
Cohasset,	2,125 60	Lincoln,	2,591 89[1]
Concord,	692 98	Littleton,	1,033 00
Danvers,	1,036 14	Lowell,	845 26
Dracut,	1,251 11	Lunenburg,	1,056 11
Dunstable,	508 80	Lynnfield,	1,013 35
Duxbury,	1,182 72	Malden,	809 74[1]
East Bridgewater,	1 50	Manchester,	359 51

---

[1] This amount includes cost of sprayer.

LIST OF CITIES AND TOWNS AND AMOUNTS OF SUPPLIES FURNISHED FOR 1917 — *Concluded.*

Mansfield,	$11 14	Saugus,	$810 27
Marblehead,	158 50	Scituate,	1,352 95
Marlborough,	1,105 47	Sharon,	1,740 69[1]
Marshfield,	1,260 73	Sherborn,	889 36
Mashpee,	537 21	Shirley,	562 80
Medfield,	666 85	Shrewsbury,	293 30
Medford,	79 25	Southborough,	548 56
Medway,	122 25	Sterling,	362 49
Merrimac,	1,083 83[1]	Stoneham,	653 57
Methuen,	1,095 31	Stoughton,	656 16[1]
Middleborough,	1,587 57	Stow,	841 80
Middleton,	1,255 04[1]	Sudbury,	1,009 45
Millbury,	25 41	Sutton,	163 25
Millis,	418 23	Taunton,	163 00
Milton,	3,496 35	Templeton,	159 83
Nantucket,	20 00	Tewksbury,	1,268 84
Natick,	233 49	Tisbury,	75 50
Needham,	1,141 00	Topsfield,	632 06
Newbury,	989 51	Townsend,	849 92
Newton,	697 60	Tyngsborough,	1,091 94
Norfolk,	187 85	Upton,	3 13
North Andover,	1,055 79	Wakefield,	747 64
North Attleborough,	122 25	Walpole,	420 80
North Reading,	932 92	Waltham,	2,548 97[1]
Northborough,	977 98	Watertown,	220 05
Norwell,	1,117 71	Wayland,	1,163 56
Norwood,	301 55	Wellesley,	1,684 50
Peabody,	652 00	Wellfleet,	619 06[1]
Pembroke,	1,490 04	Wenham,	596 71
Pepperell,	691 03	West Boylston,	167 66
Plainville,	81 05	West Bridgewater,	351 87
Plympton,	283 74	West Newbury,	568 15
Prescott,	16 30	Westborough,	402 25
Princeton,	275 41	Westford,	1,059 18
Quincy,	1,264 25	Westminster,	137 96
Raynham,	202 76	Weston,	2,634 12
Reading,	2,210 60	Wilmington,	1,243 02
Rehoboth,	494 44[1]	Winchendon,	325 91
Revere,	47 40	Winthrop,	81 50
Rochester,	557 41[1]	Woburn,	861 17
Rockport,	499 50	Worcester,	2,853 50[1]
Rowley,	1,136 23	Wrentham,	1,735 16[1]
Salisbury,	566 03		
Sandwich,	521 41		$111,750 68

---

[1] This amount includes cost of sprayer.

Dover gypsy moth fund,	$936 75
State Forest Commission,	119 43
Prevention of forest fires,	59 27
General forestry and nurseries,	245 03
Massachusetts School for Feeble-minded,	1 45
Special North Shore fund,	8,793 53
Purchase and planting of forest lands,	147 64
Lead sold,	114 10
Thinning work,	445 78
Bird houses,	154 53
Traveling sprayer,	475 96
	$11,493 47

APPROPRIATION FOR SUPPRESSION OF GYPSY AND BROWN-TAIL MOTHS.

FINANCIAL STATEMENT.

Balance on hand, Nov. 30, 1916,	$78,367 55
Less reimbursement paid for 1916,	25,213 07
Balance for 1917 work,	$53,154 48

Receipts.

Acton,	$48 64	
Andover,	820 20	
Arlington,	632 50	
Attleboro,	97 80	
Auburn,	75 52	
Ayer,	1,151 87	
Barnstable,	21 06	
Berkley,	31 25	
Beverly,	545 55	
Billerica,	301 08	
Boxford,	100 25	
Boylston,	491 35	
Brewster,	78	
Cambridge,	308 10	
Canton,	595 85	
Cohasset,	2,125 60	
Concord,	1,160 79	
Danvers,	152 37	
Eastham,	3 73	
Easthampton,	40 75	
Essex,	720 28	
Foxborough,	163 00	
Franklin,	281 36	
Gardner,	97 80	
Amounts carried forward,	$9,967 48	$53,154 48

Amounts brought forward,	$9,967 48	$53,154 48
Gloucester,	1,181 60	
Grafton,	6 06	
Groton,	267 16	
Hamilton,	431 55	
Hingham,	1,422 00	
Holden,	1,044 93	
Holliston,	157 13	
Hopkinton,	857 36	
Ipswich,	67 02	
Lakeville,	564 23	
Lancaster,	203 75	
Lincoln,	137 05	
Lowell,	1,392 69	
Lynnfield,	1,361 58	
Manchester,	316 25	
Marblehead,	158 50	
Marlborough,	358 69	
Medfield,	1,052 19	
Medford,	79 25	
Medway,	122 25	
Methuen,	49 98	
Millbury,	26 14	
Millis,	370 83	
Milton,	1,882 00	
Nantucket,	20 00	
Natick,	83 75	
Needham,	2,838 55	
Newton,	5,983 41	
North Andover,	287 33	
North Attleborough,	123 50	
Norwood,	301 55	
Peabody,	652 00	
Plainville,	66 33	
Prescott,	16 30	
Princeton,	751 55	
Quincy,	1,865 71	
Raynham,	5 92	
Rehoboth,	4 08	
Revere,	47 40	
Rockport,	499 50	
Rowley,	4 22	
Sandwich,	675 00	
Saugus,	184 36	
Amounts carried forward,	$37,888 13	$53,154 48

Amounts brought forward,	$37,888 13	$53,154 48
Sharon,	211 90	
Sherborn,	421 05	
Shirley,	6 66	
Somerset,	64 00	
Sterling,	45 06	
Stoneham,	191 30	
Stoughton,	38 81	
Sutton,	163 96	
Taunton,	163 00	
Templeton,	1,428 34	
Tisbury,	75 50	
Topsfield,	2,479 83	
Truro,	31 52	
Wakefield,	777 63	
Walpole,	326 00	
Waltham,	4,160 17	
Watertown,	220 05	
Wellesley,	1,684 50	
Wellfleet,	2 11	
Wenham,	41 10	
West Boylston,	718 71	
West Newbury,	19 02	
Weston,	723 49	
Winchendon,	2,026 75	
Winthrop,	81 50	
Woburn,	1 20	
Worcester,	2,285 67	
Gardner State Colony,	6 39	
Massachusetts School for Feeble-minded,	1 45	
Massachusetts Highway Commission,	2,722 18	
Levi H. Greenwood,	81 50	
Fitzhenry-Guptill Company,	24 45	
E. S. Jenness,	6 40	
R. S. Langdell,	8 15	
Paul D. Kneeland (expenses),	7 24	
Paul D. Kneeland, agent (thinning work),	1,535 00	
For bird houses,	157 23	
For barrels sold,	21 13	
For gasoline sold,	2 60	
For old tires sold,	2 40	
Rebate from Wells, Fargo & Co.,	25	
Checks returned from Northborough,	11 75	
Checks returned from Duxbury,	61 45	
Amounts carried forward,	$60,926 53	$53,154 48

Amounts brought forward,	$60,926 53	$53,154 48
Transfers for supplies: —		
General forestry and nurseries,	387 76	
Purchase and planting of forest lands,	147 64	
Special North Shore fund,	8,991 53	
Dover Gypsy Moth fund,	1,932 60	
State Forest Commission,	4 23	
Appropriation for investigation and suppression of white pine blister rust,	1,446 07	
		73,836 36
		$126,990 84
Appropriation of 1917,		165,000 00
		$291,990 84

Expenditures.

Pay roll,	$19,078 44	
Travel,	8,886 77	
Supplies,	148,119 18	
Rent of store,	300 00	
Storehouse equipment,	187 80	
Special work,	7,000 00	
Town pay rolls,	29,849 81	
Reimbursements,	15,974 43	
Thinning work,	303 53	
Printing,	94 86	
Stationery and postage,	85 32	
Experts,	26 10	
Sundries,	918 33	
		230,824 57
Balance Nov. 30, 1917,		$61,166 27

FINANCIAL SUMMARY OF MOTH WORK BY TOWNS.

In the following table we show the expenditures in detail for the year 1917. We also have indicated in the second and third columns of figures the amount received by each town or city for the years previous to and including 1917, — in the first column, the amounts received in the years 1905 to 1909, inclusive, and in the second column the amounts received for the years 1910 to 1917, inclusive. The last group of years covers the period since the establishment of our storehouse, during which we have furnished supplies to various towns and cities. The amounts given in supplies are included in the totals.

Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Abington,	3	$2,289 72	-	$1,498 09	-	-	-	-	-	$1,472 36
Acton,	3	6,507 90	$9,974 52	1,007 59	$1,113 76	$589 44[1] 75 90	$106 17	$861 35	$967 52	827 15
Acushnet,	3	-	-	516 42	-	-	-	-	-	609 16
Amesbury,	2	378 10	-	2,910 97	-	-	-	-	-	2,840 50
Andover,	2	6,481 29	8.967 09	3,570 38	3,938 47	1,670 84	-	1,586 70	1,563 83	3,126 90
Arlington,	1	32,589 84	4,343 41	5,000 00	-	-	-	632 50	-	5,000 00
Ashburnham,	3	-	3,351 16	503 74	1,066 99	79 25	563 25	362 76	926 01	528 33
Ashby,	3	-	3,309 52	319 16	812 52	305 36[1]	493 36	426 94	920 30	272 16
Ashland,	3	716 70	2,441 14	639 81	498 56	182 45	-	508 19	434 94	637 91
Athol,	2	-	-	2,708 91	-	-	-	-	-	2,833 00
Attleboro,	1	-	-	5,000 00	-	-	-	97 80	-	5,000 00
Auburn,	3	-	131 80	735 02	-	-	-	84 90	-	802 25
Avon,	3	-	1,646 87	467 46	518 48	24 40	51 02	124 45	175 47	480 95
Ayer,	3	-	1,992 49	998 17	562 77	29 75	-	340 27	12 62	984 06
Barnstable,	2	-	2,388 43	3,721 72	-	-	-	6 32	-	3,239 86

---

[1] Arsenate of lead sold.

Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Barre,	3	-	-	$1,137 36	-	-	-	-	-	$1,167 38
Bedford,	3	$22,022 24	$23,940 12	856 03	$1,343 21	$111 80[1] 933 22	$487 18	$1,139 23	$1,626 41	773 75
Bellingham,	3	-	-	443 66	-	-	-	-	-	461 15
Belmont,	1-2	10,183 53	584 34	5,000 00	-	-	-	-	-	4,718 18
Berkley,	3	-	738 57	238 32	230 84	82 49	-	488 93	362 45	245 02
Berlin,	3	888 65	7,443 59	269 80	685 51	110 65[1] 114 09	415 71	489 37	905 08	256 88
Beverly,	1	5,189 97	666 02	5,000 00	-	-	-	545 55	-	5,000 00
Billerica,	3-2	14,746 70	11,487 39	2,312 06	1,948 19	409 41[1] 318 43	-	1,398 26	1,034 39	2,429 99
Blackstone,	3	-	-	1,004 08	-	-	-	-	-	595 51
Bolton,	3	1,320 10	7,729 60	438 01	435 05	303 59[1] 122 75	-	753 97	751 01	312 86
Boston,	1	28,956 26	86,774 69	5,000 00	-	-	-	-	-	5,000 00
Bourne,	2-3	2,280 62	-	3,112 44	-	-	-	-	-	2,305 92
Boxborough,	3	4,160 18	13,279 83	122 74	888 66	513 09[1] 114 91	765 92	692 97	1,458 89	124 72
Boxford,	3	7,068 76	14,563 00	579 56	1,217 79	374 02[1] 179 00	638 23	731 06	1,369 29	370 73
Boylston,	3	-	3,001 25	234 29	938 50	158 43	704 21	66 17	770 38	232 96
Braintree,	2	1,445 27	1,535 76	3,989 75	-	-	-	-	-	3,707 81
Brewster,	3	-	-	419 79	-	-	-	78	-	397 57

Bridgewater,	3	143 48	3,183 10	1,782 85	1,757 42	31 96[1] 722 20	-	612 76	587 32	1,796 44
Brimfield,	3	-	-	257 58	-	-	-	-	-	268 87
Brockton,	1	-	-	5,000 00	-	-	-	-	-	5,000 00
Brookfield,	3	-	-	624 88	-	-	-	-	-	599 01
Brookline,	1	-	66 09	5,000 00	-	-	-	-	-	5,000 00
Burlington,	3	18,155 01	15,586 62	406 64	1,168 08	285 18	761 44	614 99	1,376 43	420 44
Cambridge,	1	4,059 36	-	5,000 00	-	-	-	-	-	5,000 00
Canton,	2–3	-	13.719 14	2,815 38	3,572 40	2,287 45	-	2,295 95	1,836 76	2,057 99
Carlisle,	3	12,936 37	21,143 93	242 66	1,445 73	644 21	1,203 07	586 26	1,789 33	210 13
Carver,	3	4,905 38	19,548 84	857 25	6,444 22	1,969 96	5,586 97	275 27	5,862 24	828 47
Charlton,	3	-	1 25	573 67	-	-	-	-	-	580 48
Chatham,	3	-	-	904 21	-	-	-	-	-	893 48
Chelmsford,	3	9,788 40	11,435 25	1,843 04	1,779 78	1,007 83	-	1,384 67	1,321 41	1,915 91
Chelsea,	1	-	-	5,000 00	-	-	-	-	-	5,000 00
Chilmark,	3	-	-	168 42	-	-	-	-	-	164 33
Clinton,	2	-	-	3,822 20	-	-	-	-	-	3,890 97
Cohasset,	2	4.360 18	11,838 67	3,952 08	-	-	-	2,125 60	-	2,466 12
Concord,	2	15,882 29	12,157 38	4,145 07	-	-	-	692 98	-	2,761 80
Dana,	3	-	-	185 91	-	-	-	-	-	182 48
Danvers,	2	19.661 59	11,961 13	3,453 81	3,613 21	1,057 79	-	1,036 14	956 43	3,180 27
Dartmouth,	2–3	-	-	2,472 37	-	-	-	-	-	2,259 78
Dedham,	1	-	2.250 93	5,000 00	-	-	-	-	-	5,000 00

Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Deerfield,	3	-	-	$1,101 28	-	-	-	-	-	$1,360 46
Dennis,	3	-	-	620 02	-	-	-	-	-	509 13
Dighton,	3	-	-	754 62	-	-	-	-	-	860 61
Douglas,	3	-	-	764 57	-	-	-	-	-	568 38
Dover,	2-3	$6,460 75	$1,054 85	3,652 23	-	-	-	-	-	1,000 71
Dracut,	3	4,077 88	9,798 79	1,060 90	$1,529 00	$728 50	$468 00	$1,251 11	$1,719 11	1,095 00
Dudley,	3	-	-	1,008 86	-	-	-	-	-	969 54
Dunstable,	3	2,181 31	9,410 46	284 99	934 31	342 33	649 32	508 80	1,158 12	144 52
Duxbury,	3	5,147 30	-	1,426 07	2,608 10	1,000 03	1,182 03	1,182 72	2,364 75	1,268 17
East Bridgewater,	3	5,600 72	2,414 16	1,169 82	-	-	-	1 50	-	1,307 24
Eastham,	3	-	-	187 54	-	-	-	3 73	-	175 82
Easthampton,	2	-	-	3,217 03	110 24	-	-	40 75	-	3,925 74
Easton,	2-3	-	1,058 40	3,049 75	-	-	-	-	-	1,618 75
Edgartown,	3	-	-	610 35	-	-	-	-	-	635 11
Essex,	3	7,041 13	5,363 69	538 51	703 09	386 25	164 58	254 44	419 02	518 83
Everett,	1	-	-	5,000 00	-	-	-	-	-	5,000 00
Fairhaven,	3	-	-	1,978 57	-	-	-	-	-	2,250 83

Fall River,	1	-	-	5,000 00	-	-	-	-	-	5,000 00
Falmouth,	1-2	-	2 20	5,000 00	-	-	-	-	-	2,774 32
Fitchburg,	1	-	6 73	5,000 00	-	-	-	-	-	5,000 00
Foxborough,	3	-	-	1,134 26	-	-	-	-	-	1,146 04
Framingham,	1	1,161 04	-	5,000 00	-	-	-	-	-	5,000 00
Franklin,	3	-	-	2,391 85	160 00	-	-	81 50	-	2,155 79
Freetown,	3	-	-	455 91	-	-	-	-	-	474 24
Gardner,	2	-	-	4,765 91	-	-	-	-	-	4,296 30
Georgetown,	3	4,112 34	12,472 67	550 15	820 54	50 40[1] 638 77	270 39	648 54	918 93	533 93
Gloucester,	1	3,764 24	-	5,000 00	2,547 09	651 14	-	446 62	-	5,000 00
Grafton,	3	-	-	1,532 05	700 52	185 00	-	4 23	-	1,334 07
Great Barrington,	2	-	72	3,533 27	-	-	-	-	-	3,469 34
Greenfield,	1	-	2 01	5,000 00	-	-	-	-	-	5,000 00
Groton,	3	196 72	6,777 81	2,037 92	-	-	-	-	-	1,124 62
Groveland,	3	4,503 99	7,250 30	566 94	804 93	66 77[1] 322 24	237 99	1,082 96	1,320 95	577 09
Halifax,	3	3,660 87	4,739 17	297 00	1,022 55	282 24	725 55	250 10	975 65	295 75
Hamilton,	2-3	8,394 78	9,451 28	2,948 14	2,823 69	1,410 37	-	989 96	690 01	1,471 49
Hanover,	3	6,788 22	11,401 06	953 27	1,817 50	380 81	864 23	918 74	1,782 97	725 05
Hanson,	3	2,993 36	6,331 24	675 21	725 45	28 32[1] 659 35	50 24	304 06	354 30	808 13
Harvard,	3	1,365 01	10,718 88	888 02	1,554 75	647 97[1] 403 11	666 73	1,054 19	1,720 92	758 79
Harwich,	3	-	797 05	748 76	796 09	109 65	47 33	254 13	301 46	759 81
Haverhill,	1	1,418 14	696 72	5,000 00	-	-	-	-	-	5,000 00

---

[1] Arsenate of lead sold.

Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Hingham,	2	$6 990 52	$4,452 11	$3,606 14	-	-	-	$1,422 00	-	$2,740 55
Holbrook,	3	-	712 66	748 20	$759 00	$7 00[1] 285 14	-	265 29	$265 29	696 49
Holden,	3	-	5,972 03	805 27	2,112 61	326 05	$1,307 34	195 46	1,502 80	752 17
Holliston,	3	-	58	1,289 56	-	-	-	156 35	-	806 59
Hopedale,	2-3	-	-	3,507 84	-	-	-	-	-	1,923 46
Hopkinton,	3	1,320 48	1,464 69	795 86	819 67	32 85	23 81	142 06	165 89	751 34
Hubbardston,	3	-	169 59	322 27	-	-	-	-	-	326 63
Hudson,	3	2,266 68	4,407 88	1,752 91	1,867 36	796 95	-	562 80	562 80	1,750 70
Hull,	2	-	-	3,882 18	-	-	-	-	-	4,112 01
Ipswich,	2-3	7,240 22	11,237 13	2,419 40	2,548 33	726 21[1] 753 39	-	1,134 02	1,010 36	2,211 59
Kingston,	3	1,750 64	8,926 39	697 60	892 03	291 14	194 43	12 36	206 79	638 84
Lakeville,	3	-	1,660 22	531 77	670 05	186 59	138 28	199 95	338 23	478 23
Lancaster.	2-3	-	51	2,825 00	-	-	-	203 75	-	957 23
Lawrence,	1	-	-	5,000 00	-	-	-	-	-	5,000 00
Leicester,	3	-	-	1,019 31	-	-	-	-	-	950 44
Lenox,	2	-	72	3,378 92	-	-	-	-	-	2,918 70
Leominster,	1	-	1 80	5,000 00	-	-	-	-	-	5,000 00

Lexington, ...	2	37,954 69	23,627 37	4,087 50	3,807 71	1,548 80	-	1,806 03	1,220 19	3,396 08
Leyden, ...	3	-	-	96 36	-	-	-	-	-	99 09
Lincoln, ...	3	11,231 96	17,954 34	1,694 02	2,239 30	1,814 35	-	2,591 89	2,487 17	755 21
Littleton, ...	3	3,054 50	8,944 76	529 29	101 55	{ 572 99[1] 77 60 }	-	1,033 00	605 26	516 45
Lowell, ...	1	-	2,235 40	5,000 00	-	-	-	845 26	-	5,000 00
Lunenburg, ...	3	81 34	9,026 69	678 19	1,033 48	{ 197 60[1] 995 31 }	355 29	1,056 11	1,411 40	668 27
Lynn, ...	1	23,169 11	-	5,000 00	-	-	-	-	-	5,000 00
Lynnfield, ...	3	12,922 81	17,397 91	576 85	1,807 77	728 87	1,230 92	1,013 35	2,244 27	603 05
Malden, ...	1	7,973 93	537 52	5,000 00	-	-	-	809 74	-	5,000 00
Manchester, ...	1–2	-	-	5,000 00	-	-	-	359 51	-	4,441 58
Mansfield, ...	3	-	-	1,870 49	-	-	-	11 14	-	1,886 67
Marblehead, ...	2	1,299 58	-	4,675 52	-	-	-	158 50	-	4,439 43
Marion, ...	2–3	-	-	2,427 97	-	-	-	-	-	1,289 42
Marlborough, ...	2	1,806 21	6,681 64	4,564 27	4,881 20	2,114 68	-	1,105 47	506 32	4,457 76
Marshfield, ...	3	3,384 23	11,293 21	1,122 79	1,593 36	{ 84 63[1] 1,253 96 }	470 57	1,260 73	1,731 30	1,038 17
Mashpee, ...	3	543 82	9,934 41	164 20	1,687 55	1,266 52	1,523 35	537 21	2,060 56	185 57
Mattapoisett, ...	3	-	-	1,081 48	-	-	-	-	-	733 01
Maynard, ...	3	3,277 64	989 44	1,730 40	-	-	-	-	-	1,874 24
Medfield, ...	3	-	2,044 95	1,007 37	1,426 42	736 99	362 60	666 85	869 45	857 89
Medford, ...	1	22,858 83	4,208 13	5,000 00	-	-	-	79 25	-	5,000 00
Medway, ...	3	-	-	747 00	-	-	-	122 25	-	766 34
Melrose, ...	1	9,558 67*	-	5,000 00	-	-	-	-	-	5,000 00

Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Mendon, ...	3	-	-	$298 77	-	-	-	-	-	$298 02
Merrimac, ...	3	$3,446 00	$7,240 96	694 12	$1,411 18	$279 75	$267 06	$1,083 83[1]	$900 89	636 86
Methuen, ...	2	8,112 94	7,517 02	4,158 82	3,461 72	2,200 81	-	1,095 31	318 57	4,238 23
Middleborough, ...	3	385 96	19,833 68	2,082 34	5,650 24	1,039 59	3,567 90	1,587 57	5,155 47	1,961 52
Middleton, ...	3	6.436 23	9,807 36	383 89	1,093 05	75 70[1] 521 00	259 16	1,255 04	1,064 20	396 36
Milford, ...	2	-	-	4,222 93	-	-	-	-	-	4,100 52
Millbury, ...	3	-	-	1,336 42	-	-	-	25 41	-	1,363 30
Millis, ...	3	-	23 23	622 75	-	-	-	418 23	-	592 77
Millville, ...	3	-	-	-	-	-	-	-	-	483 05
Milton, ...	1	-	9,082 33	5,000 00	7,238 44	5,877 19	-	3,496 35	2,228 87	5,000 00
Monson, ...	3	-	-	809 53	-	-	-	-	-	732 97
Montague, ...	2	-	-	3,055 50	-	-	-	-	-	3,199 20
Nahant, ...	2–3	-	-	3,556 01	-	-	-	-	-	1,663 35
Nantucket, ...	3	-	40	2,241 19	-	-	-	20 00	-	2,145 30
Natick, ...	2	8,157 83	254 56	3,801 28	5,100 71	438 09[1] 399 00	-	233 49	-	3,143 58
Needham, ...	2	4,062 91	1,580 52	3,915 13	-	-	-	1,141 00	-	3,663 50
New Bedford, ...	1	-	-	5,000 00	-	-	-	-	-	5,000 00

New Braintree,	3	-	-	172 77	-	-	-	-	-	174 07
New Salem,	3	-	-	167 56	-	-	-	-	-	197 89
Newbury,	3	12,627 11	15,854 17	714 65	1,127 91	441 85[1] 584 59	413 26	989 51	1,402 77	595 89
Newburyport,	1-2	-	-	5,000 00	-	-	-	-	-	4,531 57
Newton,	1	13,130 78	42,469 09	5,000 00	-	-	-	697 60	-	5,000 00
Norfolk,	3	-	2,241 11	478 39	640 04	178 30	161 65	187 85	349 50	472 55
North Andover,	2-3	6,283 31	7,575 64	2,452 22	2,506 27	83 45[1] 708 08	-	1,055 79	887 87	2,159 71
North Attleborough,	2	-	-	3,744 14	-	-	-	122 25	-	3,371 41
North Brookfield,	3	-	-	802 89	-	-	-	-	-	786 56
North Reading,	3	8,394 87	21,919 57	415 60	1,949 14	681 31	1,533 54	932 92	2,466 46	439 46
Northborough,	3	-	6,777 78	838 64	1,140 96	165 60[1] 306 36	302 32	977 98	1,280 30	777 62
Northbridge.	3	-	-	2,326 80	-	-	-	-	-	2,052 11
Norton,	3	-	-	681 27	-	-	-	-	-	701 16
Norwell,	3	3,818 68	9,872 63	540 92	614 89	921 33	73 97	1,117 71	1,191 68	505 42
Norwood,	1	-	1 40	5,000 00	-	-	-	301 55	-	5,000 00
Oak Bluffs,	3	-	-	821 11	-	-	-	-	-	865 02
Oakham,	3	-	-	149 10	-	-	-	-	-	157 15
Orange,	3	-	-	1,632 86	-	-	-	-	-	1,586 90
Orleans,	3	-	40	2,346 06	-	-	-	-	-	560 42
Oxford,	3	-	-	854 07	-	-	-	-	-	855 22
Palmer,	3	-	-	2,287 93	-	-	-	-	-	2,356 77
Paxton,	3	-	6 84	172 87	-	-	-	-	-	170 68

---

[1] Arsenate of lead sold.

Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Peabody,	1	$16,750 89	$2.313 14	$5,000 00	-	-	-	$652 00	-	$5,000 00
Pembroke,	3	2,010 07	14,411 44	528 25	$1,679 31	$985 00	$1,151 06	1,490 04	$2,641 10	513 71
Pepperell,	3	1,616 38	11,691 88	978 77	1,874 22	297 27	895 45	691 03	1,586 48	973 33
Petersham,	3	-	-	468 73	-	-	-	-	-	409 08
Phillipston,	3	-	6 84	131 86	-	-	-	-	-	131 28
Plainville,	3	-	520 60	428 75	473 99	180 18	45 24	81 05	126 29	438 51
Plymouth,	1	-	-	5,000 00	-	-	-	-	-	5,000 00
Plympton,	3	7,945 65	13,011 74	188 57	1,508 13	135 00	1,319 56	283 74	1,603 30	198 07
Princeton,	3	-	14,068 60	902 84	2,787 97	132 30	1,885 13	275 41	2,160 54	438 93
Provincetown,	3	-	-	1,111 97	-	-	-	-	-	1,065 05
Quincy,	1	2,170 39	2.152 52	5,000 00	-	-	-	1,264 25	-	5,000 00
Randolph,	3	-	92 74	1,176 00	-	-	-	-	-	1,120 90
Raynham,	3	70 80	1,305 70	402 67	369 09	142 24	-	202 76	169 18	409 97
Reading,	2	22,665 08	14,336 52	3,327 59	3,249 95	2,276 50	-	2,210 60	1,706 37	3,087 12
Rehoboth,	3	-	197 78	432 90	261 24	273 31	-	494 44	197 78	446 94
Revere,	1	1,615 16	-	5,000 00	-	-	-	47 40	-	5,000 00
Rochester,	3	195 09	446 35	425 37	333 44	10 43	-	557 41	340 48	425 89

Rockland,	3	868 30	1,131 13	2,211 25	-	-	-	-	-	2,091 60
Rockport,	3	1,963 08	1,337 64	1,672 14	-	-	-	499 50	-	1,674 62
Rowley,	3	3,662 32	7,110 56	924 43	919 03	349 78	-	1,136 23	1,130 83	388 92
Royalston,	3	-	24 46	303 60	-	-	-	-	-	321 46
Rutland,	3	-	-	371 92	-	-	-	-	-	380 48
Salem,	1	11,844 56	365 56	5,000 00	-	-	-	-	-	5,000 00
Salisbury,	3	7,432 39	10,038 89	717 00	1,242 98	131 40[1] 364 14	525 98	566 03	1,092 01	753 44
Sandwich,	3	622 91	2,504 50	622 00	526 72	100 08[1] 20 00	-	521 41	426 13	538 70
Saugus,	2	55,011 99	19,145 56	2,932 90	2,804 45	322 24	-	810 27	545 46	2,979 20
Scituate,	2–3	1,351 60	26,979 25	2,422 83	3,051 88	2,087 90	232 65	1,352 95	1,315 01	2,290 97
Seekonk,	3	-	-	839 81	-	-	-	-	-	805 78
Sharon,	3	-	1,128 79	1,578 09	2,438 44	8 64	-	1,740 69	1,128 79	1,360 82
Sherborn,	3	3,726 29	4,796 20	1,009 04	1,074 61	682 14	65 57	889 36	954 93	655 04
Shirley,	3	-	4,344 04	544 24	868 60	102 00[1] 385 15	324 36	562 80	887 16	551 63
Shrewsbury,	3	-	1,265 76	1,338 49	2,269 73	496 30	931 24	293 30	1,224 54	1,370 92
Somerset,	3	-	-	753 53	260 50	-	-	-	-	775 25
Somerville,	1	427 52	-	5,000 00	-	-	-	-	-	5,000 00
Southborough,	3	3,586 16	5,740 36	985 64	1,380 82	709 93	395 18	548 56	943 74	867 82
Spencer,	3	-	-	1,462 28	-	-	-	-	-	1,394 44
Springfield,	1	-	-	5,000 00	-	-	-	-	-	5,000 00
Sterling,	3	-	5,018 73	559 38	850 17	149 65	190 79	362 49	553 28	545 18
Stockbridge,	3	-	-	1,828 02	-	-	-	-	-	1,783 43

---

[1] Arsenate of lead sold.

Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Stoneham, ...	2	$26,874 45	$7,363 59	$2,499 86	$2,499 86	$1,483 85	-	$653 57	$522 86	$2,544 14
Stoughton, ...	3	-	2,285 61	1,925 92	1,887 91	541 09	-	656 16	492 15	1,953 36
Stow, ...	3	2,117 79	10,201 23	464 29	1,102 81	394 46[1] 335 28	$313 02	841 80	1,154 82	404 70
Sturbridge, ...	3	-	-	382 53	-	-	-	-	-	377 30
Sudbury, ...	3	4,474 07	12,682 46	672 37	1,210 43	467 79[1] 272 94	538 06	1,009 45	1,547 51	577 93
Sutton, ...	3	-	-	618 76	-	-	-	163 25	-	615 46
Swampscott, ...	1	6,903 06	397 71	5,000 00	-	-	-	-	-	5,000 00
Swansea, ...	3	-	-	810 01	-	-	-	-	-	717 36
Taunton, ...	1	-	-	5,000 00	-	-	-	163 00	-	5,000 00
Templeton, ...	3	-	2,923 07	819 06	1,132 28	346 00	313 22	159 83	473 05	838 65
Tewksbury, ...	3	5,196 08	14,060 63	988 44	1,830 85	631 83	842 41	1,268 84	2,111 25	1,080 63
Tisbury, ...	3	-	-	970 27	-	-	-	75 50	-	837 94
Topsfield, ...	3	6,472 26	5,556 47	2,071 56	1,596 69	371 18	-	632 06	157 19	835 27
Townsend, ...	3	-	8,464 75	585 99	1,140 33	104 42[1] 429 36	554 34	849 92	1,404 26	557 20
Truro, ...	3	-	192 71	220 42	221 00	11 57	-	-	-	213 19
Tyngsborough, ...	3	4,512 39	17,701 66	334 41	2,369 99	54 60[1] 844 32	2,035 58	1,091 94	3,127 52	344 27
Upton, ...	3	-	-	524 31	-	-	-	3 13	-	500 91

Uxbridge, ...	3	-	-	1,851 64	-	-	-	-	-	1,622 92
Wakefield, ...	1	11,068 41	2,425 09	5,000 00	-	-	-	546 92	-	5,000 00
Walpole, ...	2	-	1,029 76	3,064 53	-	-	-	420 80	-	2,875 16
Waltham, ...	1	6,416 37	8,458 76	5,000 00	12,383 02	3,002 48	-	2,548 97	-	5,000 00
Ware, ...	3	-	-	2,178 37	-	-	-	-	-	2,102 10
Wareham, ...	2	-	-	2,601 86	-	-	-	-	-	2,424 35
Warren, ...	3	-	-	1,068 89	-	-	-	-	-	1,055 77
Warwick, ...	3	-	-	188 23	-	-	-	-	-	181 58
Watertown, ...	1	5,270 02	2 55	5,000 00	-	-	-	220 05	-	5,000 00
Wayland, ...	3	8,505 68	12,250 86	1,358 76	997 93	588 40[1] 993 38	-	1,163 56	802 73	948 84
Webster, ...	2–3	-	-	3,685 51	-	-	-	-	-	2,383 03
Wellesley, ...	1	1,473 50	662 96	5,000 00	-	-	-	1,684 50	-	5,000 00
Wellfleet, ...	3	-	575 36	340 51	546 81	86 45	81 30	619 06	575 36	322 69
Wendell, ...	3	-	-	223 88	-	-	-	-	-	228 18
Wenham, ...	3	9,207 22	9,023 67	1,465 94	1,565 55	431 46	-	596 71	-	843 92
West Boylston, ...	3	-	1,857 87	449 45	650 74	320 20	201 29	167 66	368 95	436 90
West Bridgewater, ...	3	2,480 22	7,437 90	803 76	1,355 48	397 65	551 72	351 87	903 59	755 60
West Newbury, ...	3	12,651 31	7,711 43	454 71	584 38	111 32[1] 288 44	129 67	568 15	697 82	406 41
West Tisbury, ...	3	-	-	256 81	-	-	-	-	-	232 34
Westborough, ...	3	-	3,176 73	1,327 68	1,673 44	910 33	345 76	402 25	748 01	1,333 93
Westford, ...	3	6,594 82	15,572 95[2]	991 20	–[3]	-	-	1,059 18	-	929 94
Westminster, ...	3	-	6,257 66	405 24	1,066 10	149 27	660 86	137 96	798 82	394 05

---

[1] Arsenate of lead sold.

[2] These figures only to 1916.

[3] These figures not in for 1917.

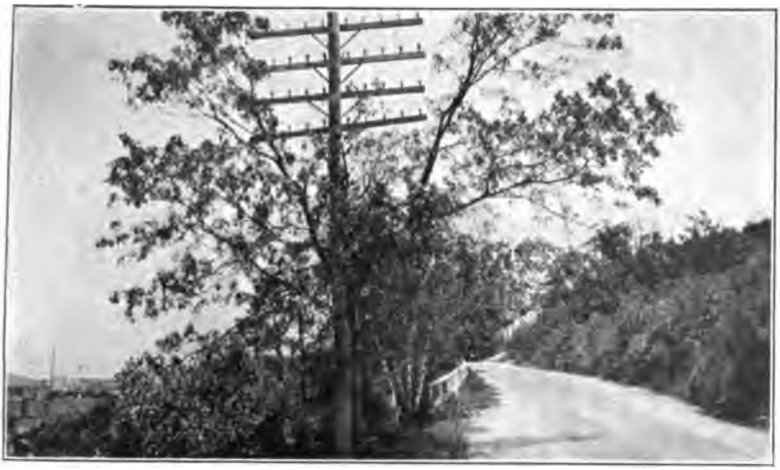
Cities and Towns.	Class.	Total Amount received from State.		1917.						1918.
		1905 to 1909, inclusive.	1910 to 1917, inclusive.	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Weston,	1-3	$21,106 61	$19,600 80	$5,000 00	$3,085 85	$2,479 95	-	$2,634 12	$359 98	$1,997 26
Westport,	3	-	-	1,063 72	-	-	-	-	-	1,102 16
Westwood,	3	-	1,028 30	2,370 23	-	-	-	-	-	990 30
Weymouth,	1	3,639 99	2,798 00	5,000 00	-	-	-	-	-	5,000 00
Whately,	3	-	5 26	301 28	-	-	-	-	-	319 17
Whitman,	2-3	-	-	2,465 83	-	-	-	-	-	2,270 11
Wilmington,	3	10,969 96	21,272 13	875 87	2,123 39	956 02	$1,247 52	1,243 02	2,490 54	864 35
Winchendon,	3	-	4,625 85	1,787 01	2,837 56	515 54	1,050 55	325 92	1,376 47	1,791 56
Winchester,	1	14,875 11	-	5,000 00	-	-	-	-	-	5,000 00
Winthrop,	1	-	-	5,000 00	-	-	-	81 50	-	5,000 00
Woburn,	1	22,460 09	21,504 96	5,000 00	5,956 90	1,019 80	-	861 17	861 17	5,000 00
Worcester,	1	-	2,990 71	5,000 00	9,582 70	4,456 85	-	2,853 50	750 00	5,000 00
Wrentham,	3	-	643 33	660 53	193 70	227 85	-	1,735 16	643 33	680 35
Yarmouth,	3	-	-	1,025 43	-	-	-	-	-	731 25

MEETINGS AND ADDRESSES.

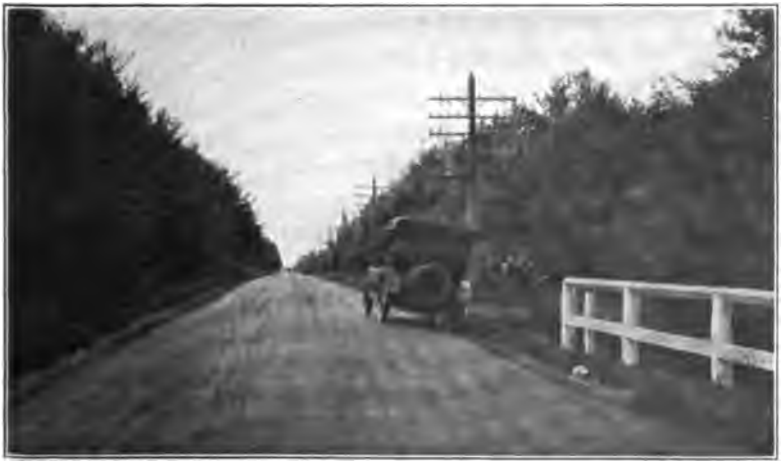
The department has had the usual calls for addresses and talks from various organizations, and the following list gives the names of various associations that have been attended: —

Acton Woman's Club.
Needham and Wellesley Farmers' Club.
Eastern Foresters' Association, Washington, D. C.
American Forestry Association.
Haverhill Unitarian Church Men's Club.
New England Nurserymen's Association, New London, Conn.
Forest Owners' Club, New York City, N. Y.
Farmers' Institute, Ashby.
Massachusetts Horticultural Society.
Worcester County Harvest Club, Worcester.
New England Federation for Rural Progress.
Waban Beacon Club.
Massachusetts moth superintendents' meeting.
Massachusetts Tree Wardens' and Foresters' Association.
Forest Fire Insurance Association, Concord, N. H.
Shirley Farmers' Club.
Berlin Tuesday Club.
Eastern Lumbermen's Association, Bangor, Me.
University of Maine, Forestry School.
Congregational Club, Auburndale.
Eastern Shook and Wooden Box Association.
Boston City Club.
Walpole Arbor Day Celebration.
Farmers' Institute, Edgartown.
Eastern Foresters' Association, Plattsburg, N. Y.
Cape Cod Cranberry Association, Wareham.
Stockbridge Town Club.
Nantucket citizens' meeting.
Cape Cod moth officials, Bourne.
Westford Grange.
Hampshire County Pomona Grange.
Worcester and Norfolk Pomona Grange.
Society for the Promotion of Agricultural Science, Washington, D. C.
Massachusetts State Board of Agriculture.
Massachusetts State Grange.
Appalachian Mountain Club, Director.
Berlin Men's Club.
Duxbury, Mayflower Pomona Grange.
Medfield, Conservation Committee of Federation of Women's Clubs.
Foxborough Grange.

Belmont, citizens' meeting.
State Grange meeting at Cummington.
Warwick, Mount Grace meeting.
Salisbury, citizens' meeting.
Salem, Universalist Men's Club.
Rowley, citizens' meeting.
Newburyport, citizens' meeting.
Merrimac, citizens' meeting.
Manchester, public meeting.
Haverhill, Order of Moose.
Tree Wardens' Convention.
Danvers, citizens' meeting.
Haverhill, Universalist Club.
Boxford Men's Club.
Beverly, conservation committee.
Haverhill, Order of American Mechanics.
Amesbury, citizens' meeting.
Stockbridge Men's Club.
Public schools, Cambridge.
Worcester County Extension School, Royalston.
Hubbardston's Men's Club, Hubbardston.
Daughters American Revolution, Natick.
Hampden League Council, Brimfield.
Hampden League Council, Montgomery.



An example of how indifferently roadside trees are cared for in some sections of the State. The lumberman has cut everything to the road on the right-hand side, and the few would-be trees have the heart taken out of them by the telephone poles and wires on the other side. Hundreds of instances may be seen of equal maltreatment of roadsides in the State due to lack of a uniform State-wide supervision and direction of effort.



The effect of white pine growth bordering a State highway. These trees are about one-half grown. They are beautiful in winter or summer, are not expensive to care for, and greatly increase the value of forest products for the section. The danger from forest fires is much less with pines, as the needles adhere more closely to the ground and are less combustible than deciduous leaves (Middleborough).

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS.

[Alphabetically by towns and cities.]

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
157-W, Rockland,	Sumner L. Deane,	**Abington,**	C. F. Shaw,	4
71-4, West Acton,	Wm. H. Kingsley,	**Acton,**	J. O'Neil,	2
2003-M, New Bedford.	Henry F. Taber,	**Acushnet,**	A. P. R. Gilmore,	3
201, Kippers,	John Clancy,	**Adams,**	John Clancy,	5
6465-M, River,	E. M. Hitchcock,	**Agawam,**	E. M. Hitchcock,	5
161-6, Great Barrington.	W. F. Milligan,	**Alford,**	- - -	-
274-M,	Jas. E. Feltham,	**Amesbury,**	A. L. Stover,	1
541-M,	A. F. Bardwell,	**Amherst,**	W. H. Smith,	5
324-M,	Chas. S. Buchan,	**Andover,**	J. H. Playdon,	1
85 and 206,	Walter H. Pierce,	**Arlington,**	Daniel M. Daley,	1
- -	John T. Withington,	**Ashburnham,**	Charles H. Pratt,	2
2-3,	W. S. Green,	**Ashby,**	Fred C. Allen,	2
3-5,	Ralph Tredick,	**Ashfield,**	Charles A. Smith,	5
704-M and 199,	H. H. Piper,	**Ashland,**	Theodore P. Hall,	2
6 and 48-5,	Frank P. Hall,	**Athol,**	W. S. Penniman,	5
34-R-4,	H. R. Packard,	**Attleboro,**	W. E. S. Smith,	3
5-12,	J. F. Searle,	**Auburn,**	B. F. Searle,	5
3259-M,	J. W. McCarty,	**Avon,**	W. W. Beals,	3
123-2,	D. C. Smith,	**Ayer,**	D. C. Smith,	2
144-2,	H. C. Bacon,	**Barnstable,**	Robert Cross,	4
83-4,	A. E. Traver,	**Barre,**	James A. Dwinnell,	5
8000 and 18,	P. B. McCormick,	**Becket,**	- - -	-
- -	Irving C. Waite,	**Bedford,**	W. A. Cutler,	2
- -	J. A. Peeso,	**Belchertown,**	E. C. Howard,	5
8936-2, Milford,	L. F. Thayer,	**Bellingham,**	Lewis E. Whitney,	3
409-W,	John F. Leonard,	**Belmont,**	Martin Troy,	2
1367-M,	Gideon H. Babbitt,	**Berkley,**	A. A. Briggs,	3
24-4,	E. Guy Sawyer,	**Berlin,**	E. C. Ross,	2
43-12,	Edson W. Hale,	**Bernardston,**	Edwin D. Hale,	5
20,	Robert H. Grant,	**Beverly,**	Jas. W. Blackmer,	1
- -	Mark E. Allen,	**Billerica,**	Fred L. Winship,	2
9250,	John H. Dwyer,	**Blackstone,**	A. J. Duggan,	5
16-3,	I. E. Whitney,	**Blandford,**	- - -	-
9-3,	Albert I. Pardee,	**Bolton,**	C. E. Mace,	2
- -	- - -	**Boston,**	Wm. P. Long,	1
38,	Walter E. R. Nye,	**Bourne,**	Edw. D. Nickerson,	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
102-2, West Acton,	H. J. Livermore,	**Boxborough,**	C. E. Sherry,	2
19-25,	Clarence E. Brown,	**Boxford,**	C. Perley,	1
4-4,	John N. Flagg,	**Boylston,**	Walter G. Brigham,	5
433-R,	James M. Cutting,	**Braintree,**	Clarence R. Bestick,	3
76-R-23,	T. B. Tubman,	**Brewster,**	Allison D. Rogers,	4
281-3,	F. C. Worthen,	**Bridgewater,**	F. C. Worthen,	4
18-2,	G. E. Hitchcock,	**Brimfield,**	C. W. King,	5
- -	Wm. F. Daly,	**Brockton,**	Rufus H. Carr,	4
109-13,	P. E. Gadaire,	**Brookfield,**	J. H. Conant,	5
- -	Geo. H. Johnson,	**Brookline,**	Ernest B. Dane,	1
- -	Gilbert E. Griswold,	**Buckland,**	- - -	-
15-4,	Walter W. Skelton,	**Burlington,**	W. W. Skelton,	2
- -	- - -	**Cambridge,**	J. F. Donnelly,	2
24-M and 21048,	Ralph C. Crowell,	**Canton,**	Wm. H. Gallivan,	3
76-M, Concord,	Geo. G. Wilkins,	**Carlisle,**	G. G. Wilkins,	2
16-2,	Herbert F. Atwood,	**Carver,**	H. F. Atwood,	4
14-12,	Albert L. Veber,	**Charlemont,**	- - -	-
42-2,	Edward A. Lamb,	**Charlton,**	J. D. Fellows,	5
28-3,	Geo. W. Ryder,	**Chatham,**	Chas. R. Nickerson,	4
1597-R,	Arnold C. Perham,	**Chelmsford,**	M. A. Bean,	2
- -	- - -	**Chelsea,**	J. A. O'Brien,	1
- -	S. W. Curtis,	**Cheshire,**	- - -	-
- -	Wm. H. Babb,	**Chester,**	- - -	-
4-2,	Chas. A. Bisbee,	**Chesterfield,**	- - -	-
149-M and 149-W,	John E. Pomphret,	**Chicopee,**	Edw. Bourbeau,	5
- -	Robert W. Vincent,	**Chilmark,**	A. S. Tilton,	4
352-24,	D. W. Blanchard,	**Clarksburg,**	F. E. Bishop,	5
312-W,	A. J. Robinson,	**Clinton,**	Peter R. Gibbons,	2
260,	Wm. J. Brennock,	**Cohasset,**	George Young,	4
23-2,	Frank A. Walden,	**Colrain,**	Edgar F. Copeland,	5
75-W,	Harry E. Tuttle,	**Concord,**	H. P. Richardson,	2
- -	Edgar Jones,	**Conway,**	- - -	-
- -	Thomas A. Gabb,	**Cummington,**	- - -	-
86-W,	S. L. Caesar,	**Dalton,**	- - -	-
- -	T. L. Thayer,	**Dana,**	T. L. Thayer,	5
417-M,	M. H. Barry,	**Danvers,**	T. E. Tinsley,	1
1658-5,	Chas. H. Mead,	**Dartmouth,**	E. M. Munson,	3

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
35-R,	Henry J. Harrigan,	**Dedham,**	J. T. Kennedy,	3
– –	Wm. L. Harris,	**Deerfield,**	Wm. S. Harris,	5
8118-4,	Chas. E. Pierce,	**Dennis,**	Joshua Crowell,	4
29-3,	Ralph Earle,	**Dighton,**	Albert N. Goff,	3
11-4,	W. L. Church,	**Douglas,**	F. J. Libby,	5
63-11,	John Breagy,	**Dover,**	H. L. MacKenzie,	3
– –	Frank H. Gunther,	**Dracut,**	T. F. Carrick,	2
– –	Frank A. Putnam,	**Dudley,**	Herbert J. Hill,	5
5-11, Tyngsborough.	Archie W. Swallow,	**Dunstable,**	W. H. Savill,	2
82-2,	H. E. Merry,	**Duxbury,**	John D. Morrison,	4
8110,	H. L. Belknap,	**E. Bridgewater,**	Lester W. Bourne,	4
– –	Asher Markham,	**E. Longmeadow,**	Herman W. King,	5
24-3,	Adin L. Gill,	**Eastham,**	N. P. Clark,	4
306-12,	John M. Dineen,	**Easthampton,**	Chas. Kuhfuss,	5
76 and 67,	Frederick Hanlon,	**Easton,**	R. W. Melendy,	3
241-2,	Manuel Swarts,	**Edgartown,**	John P. Fuller,	4
165-25,	Frank W. Bradford,	**Egremont,**	– – –	–
17-11,	H. A. Coolbeth,	**Enfield,**	H. C. Moore,	5
– –	C. H. Holmes,	**Erving,**	Chas. H. Holmes,	5
– –	Otis O. Story,	**Essex,**	O. O. Story,	1
– –	– – –	**Everett,**	P. O. Sefton,	2
1666-Y,	C. F. Benson,	**Fairhaven,**	G. W. King,	3
823-W,	Wm. Stevenson,	**Fall River,**	Wm. Stevenson,	3
136-2,	H. H. Lawrence,	**Falmouth,**	W. W. Eldridge, Jr.,	4
745,	Page S. Bunker,	**Fitchburg,**	Dwight S. Woodworth,	2
9417-3, Hoosac Tunnel pay station.	Horace B. Brown,	**Florida,**	– – –	–
76 and 96-5,	Ernest A. White,	**Foxborough,**	F. S. Richardson,	3
352-4,	Bert P. Winch,	**Framingham,**	N. I. Bowditch,	2
66-12,	Edward S. Cook,	**Franklin,**	J. W. Stobbart,	3
8-3,	A. M. Hathaway,	**Freetown,**	G. M. Nichols,	3
161 and 191,	Geo. S. Hodgman,	**Gardner,**	T. W. Danforth,	5
– –	L. B. Smalley,	**Gay Head,**	J. W. Belain,	4
71-12 and 8046-2,	Thos. C. Watson,	**Georgetown,**	Elwood T. Wildes,	1
15-12, Bernardston.	Lewis C. Munn,	**Gill,**	Chas. H. Whitaker,	5
1280 and 1043,	Geo. W. O'Maley,	**Gloucester,**	Geo. W. O'Maley,	1
18-4,	John S. Mollison,	**Goshen,**	– – –	–
– –	Harold S. Veeder,	**Gosnold,**	– – –	–

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
18-2,	Elmer E. Sibley,	**Grafton,**	C. K. Despeau,	5
- -	Geo. L. Murray,	**Granby,**	George A. Harris,	5
25,	Harry A. Root,	**Granville,**	- - -	-
327-W,	D. W. Flynn,	**Gt. Barrington,**	T. J. Kearin,	5
1185,	J. W. Bragg,	**Greenfield,**	J. W. Bragg,	5
33-24, Enfield,	W. H. Walker,	**Greenwich,**	B. A. Sawtelle,	5
71-5,	C. M. Raddin,	**Groton,**	Herbert W. Taylor,	2
2939-M,	S. E. Johnson,	**Groveland,**	R. D. Larive,	1
651-33,	E. P. West,	**Hadley,**	Leroy C. Sabin,	5
5-2,	Wm. L. Robertson,	**Halifax,**	F. D. Lyon,	4
- -	Fred Berry,	**Hamilton,**	E. G. Brewer,	1
5-14,	Edward P. Lyons,	**Hampden,**	- - -	-
17-F-2,	Charles Tucker,	**Hancock,**	- - -	-
51-5, Rockland,	Chas. E. Damon,	**Hanover,**	L. Russell,	4
12-23,	Geo. T. Moore,	**Hanson,**	George T. Moore,	4
3-12,	George Fay,	**Hardwick,**	George J. Fay,	5
46-3,	Benjamin J. Priest,	**Harvard,**	G. C. Maynard,	2
103-3,	John Condon,	**Harwich,**	Arthur F. Cahoon,	4
72-4,	Fred T. Bardwell,	**Hatfield,**	Seth W. Kingsley,	5
- -	John B. Gordon,	**Haverhill,**	M. J. Fitzgerald,	1
17-7,	Herbert A. Holden,	**Hawley,**	- - -	-
5-18,	S. G. Benson,	**Heath,**	- - -	-
500,	George Cushing,	**Hingham,**	T. L. Murphy,	4
7-12,	A. N. Warren,	**Hinsdale,**	- - -	-
130-R, Randolph,	Melvin L. Coulter,	**Holbrook,**	Bradford Parks,	3
42-4,	Winfred H. Stearns,	**Holden,**	W. H. Stearns,	5
5-21, Brimfield,	Oliver L. Howlett,	**Holland,**	W. A. Morse,	5
113,	W. A. Collins,	**Holliston,**	Herbert E. Jones,	2
1167-W,	C. J. Haley,	**Holyoke,**	T. A. Bray,	5
248-W,	S. E. Kellogg,	**Hopedale,**	C. E. Nutting,	5
19,	George W. Smith,	**Hopkinton,**	W. A. MacMillan,	5
35-11,	W. L. Lovewell,	**Hubbardston,**	Ralph W. Hartwell,	5
24,	M. P. Mitchell,	**Hudson,**	George A. Coolidge,	2
- -	- - -	**Hull,**	J. Knowles,	4
4-11,	John J. Kirby,	**Huntington,**	- - -	-
74-R,	Arthur H. Walton,	**Ipswich,**	J. A. Morey,	1
- -	Dr. A. B. Holmes,	**Kingston,**	Chas. H. Childs,	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
261-W,	N. F. Washburn,	**Lakeville,**	N. F. Washburn,	4
– –	Arthur W. Blood,	**Lancaster,**	L. R. Griswold,	2
1295-24,	King D. Keeler,	**Lanesborough,**	George H. Judivine,	5
362,	D. E. Carey,	**Lawrence,**	John A. Flanagan,	1
66-M,	James W. Bossidy,	**Lee,**	– – –	–
37-5,	B. H. Fogwell,	**Leicester,**	J. H. Woodhead,	5
– –	Oscar R. Hutchinson,	**Lenox,**	T. Francis Mackey,	5
28, 29 and 546,	F. A. Russell,	**Leominster,**	D. E. Bassett,	2
– –	Mellen H. Briggs,	**Leverett,**	I. H. Taylor,	5
1104-R,	Osborne J. Gorman,	**Lexington,**	O. J. Gorman,	2
274-41, Greenfield,	Jacob Sauter,	**Leyden,**	Jacob Sauter,	5
44-W,	John J. Kelliher,	**Lincoln,**	J. J. Kelliher,	2
17-4,	A. E. Hopkins,	**Littleton,**	A. E. Hopkins,	2
– –	Oscar C. Pomeroy,	**Longmeadow,**	– – –	–
3400,	Edw. F. Saunders,	**Lowell,**	J. G. Gordon,	2
1-12,	H. A. Munsing,	**Ludlow,**	Ashley N. Bucher,	5
20,	J. S. Gilchrest,	**Lunenburg,**	James S. Gilchrest,	2
1174 and 3015,	George A. Cornet,	**Lynn,**	Arthur W. Lewis,	1
9-3,	Lewis F. Pope,	**Lynnfield,**	L. H. Twiss,	1
– –	Watson B. Gould,	**Malden,**	W. B. Gould,	2
319-W,	Peter A. Sheahan,	**Manchester,**	P. A. Sheahan,	1
1-R and 281-W,	Herbert E. King,	**Mansfield,**	E. Jasper Fisher,	3
– –	John T. Adams,	**Marblehead,**	W. J. Stevens,	1
117-2,	George B. Nye,	**Marion,**	J. Allenach,	4
– –	Edward C. Minehan,	**Marlborough,**	M. E. Lyons,	2
43-3,	W. G. Ford,	**Marshfield,**	P. R. Livermore,	4
31-2, Cotuit,	Darius Coombs,	**Mashpee,**	S. Henry Peters,	4
13-3,	Frank Tinkham,	**Mattapoisett,**	Frank A. Tinkham,	4
– –	Geo. H. Gutteredge,	**Maynard,**	A. Coughlin,	2
119-4,	William E. Bell,	**Medfield,**	G. L. L. Allen,	3
– –	Chas. E. Bacon,	**Medford,**	Hugh G. Kennedy,	2
6-2,	John B. Durfee,	**Medway,**	F. Hager,	3
– –	– – –	**Melrose,**	J. J. McCullough,	2
188-M,	F. M. Aldrich,	**Mendon,**	F. M. Aldrich,	5
85,	Chas. E. Hoyt,	**Merrimac,**	C. R. Ford,	1
2747,	W. M. Freeman,	**Methuen,**	A. H. Wagland,	1
222-W,	W. H. Connor,	**Middleborough,**	John J. Fowler,	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
8000,	G. E. Cook,	**Middlefield,**	- - -	-
63-25 and 63-14,	L. G. Esty,	**Middleton,**	B. T. McGlauflin,	1
37-M,	E. J. Burke,	**Milford,**	P. F. Fitzgerald,	5
152-2,	Harry L. Snelling,	**Millbury,**	E. F. Roach,	5
5-2,	Charles LaCroix,	**Millis,**	Everett Caldwell,	3
1442-25,	Ralph S. Carpenter,	**Milton,**	Ralph S. Carpenter,	3
1149-J-1,	Robert McLaughlin,	**Millville,**	Robert McLaughlin,	5
8-22, Readsboro, Vt.	Huel S. Tower,	**Monroe,**	- - -	-
12-22,	O. E. Bradway,	**Monson,**	Robt. S. Fay,	5
14-4,	Thomas Berard,	**Montague,**	F. H. Gillette,	5
164-25,	Jasper H. Bills,	**Monterey,**	- - -	-
3-24,	A. J. Hall,	**Montgomery,**	- - -	-
17-6,	Howard Porter,	**Mt. Washington,**	- - -	-
- -	- - -	**Nahant,**	T. Roland,	1
16-3,	E. W. Francis,	**Nantucket,**	George M. Winslow,	4
- -	Wm. H. Connelly,	**Natick,**	S. H. Hunnewell,	2
195-W,	H. H. Upham,	**Needham,**	E. E. Riley,	3
- -	Chas. S. Baker,	**New Ashford,**	- - -	-
- -	Edward F. Dahill,	**New Bedford,**	C. F. Lawton,	3
6-4, Gilbertville,	Frank A. Morse,	**New Braintree,**	E. L. Havens,	5
8005-2,	E. M. Stanton,	**New Marlborough.**	- - -	-
10, Cooleyville,	Sewall V. King,	**New Salem,**	Sewall V. King,	5
1112-5,	Wm. P. Bailey,	**Newbury,**	Percy Oliver,	1
380,	Chas. P. Kelley,	**Newburyport,**	C. P. Kelley,	1
30, Newton South,	W. B. Randlett,	**Newton,**	W. W. Colton,	2
129-4, Franklin,	Lester J. Murphy,	**Norfolk,**	James T. Buckley,	3
205-W,	H. J. Montgomery,	**North Adams,**	Jackson L. Temple,	5
1029-J,	Wm. L. Smith,	**No. Andover,**	Wm. L. Smith,	1
- -	H. W. Tufts,	**North Attleborough.**	F. P. Toner,	3
63-4,	Oscar C. Hirbour,	**North Brookfield,**	S. D. Colburn,	5
49,	Geo. E. Eaton,	**North Reading,**	G. E. Eaton,	2
165,	F. E. Chase,	**Northampton,**	Chas. A. Maynard,	5
12-11,	Clarence E. Bailey,	**Northborough,**	Lewis H. Smith,	5
71-5 and 182,	W. E. Burnap,	**Northbridge,**	A. F. Whitin,	5
114-2,	F. W. Doane,	**Northfield,**	F. W. Doane,	5
29-11,	Geo. H. Storer,	**Norton,**	G. H. Storer,	3
7-12,	J. H. Sparrell,	**Norwell,**	J. H. Sparrell,	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
417-M,	F. W. Talbot,	**Norwood,**	C. A. Bingham,	3
119-4,	Harold W. Chase,	**Oak Bluffs,**	Frank F. Blankenship.	4
17-5,	C. H. Trowbridge,	**Oakham,**	C. H. Trowbridge,	5
232-12,	Wm. Walsh,	**Orange,**	Jas. W. Cooper,	5
33-2,	James Boland,	**Orleans,**	A. Smith,	4
- -	Durand A. Witter,	**Otis,**	- - -	-
9-5,	Olin D. Vickers,	**Oxford,**	C. G. Larned,	5
53-3 and 53-12,	James Summers,	**Palmer,**	C. H. Keith,	5
- -	F. L. Durgin,	**Paxton,**	F. L. Durgin,	5
- -	John J. Callahan,	**Peabody,**	J. J. Callahan,	1
59-R and 59-W, Amherst.	John Hubbard,	**Pelham,**	Marion E. Richardson.	5
83-3, Bryantville, 8029-2, Bryantville, 8007-13, Hanover.	Joseph J. Shepherd,	**Pembroke,**	Wm. C. Jones,	4
23-21,	G. M. Palmer,	**Pepperell,**	J. Tune,	2
11-2, Hinsdale,	Arthur Kilbourne,	**Peru,**	- - -	-
61,	George Marsh,	**Petersham,**	Daniel Broderick,	5
228-Y, Athol,	Wm. H. Cowlbeck,	**Phillipston,**	W. H. Cowlbeck,	5
834 and 535-M,	Chas. L. Klein,	**Pittsfield,**	- - -	-
33-11,	F. J. Butler,	**Plainfield,**	- - -	-
- -	Henry F. Boerger,	**Plainville,**	George H. Snell,	3
264,	Ira C. Ward,	**Plymouth,**	A. A. Raymond,	4
13-7, Kingston,	David L. Bricknell,	**Plympton,**	D. L. Bricknell,	4
19-4, Cooleyville,	Fred W. Doubleday,	**Prescott,**	C. M. Pierce,	5
13-4,	Fred W. Bryant,	**Princeton,**	F. A. Skinner,	5
49-11,	J. H. Barnett,	**Provincetown,**	J. M. Burch,	4
1,	Faxon T. Billings,	**Quincy,**	A. J. Stewart,	3
279,	R. F. Forrest,	**Randolph,**	John T. Moore,	3
1161-W,	E. E. Chickering,	**Raynham,**	G. M. Leach,	3
518-W,	H. E. McIntire,	**Reading,**	H. M. Donegan,	2
11-12,	B. F. Munroe,	**Rehoboth,**	R. E. Anderson,	3
- -	- - -	**Revere,**	G. P. Babson,	1
8-2,	Timothy B. Salmon,	**Richmond,**	- - -	-
12-32,	Daniel E. Hartley,	**Rochester,**	Samuel H. Corse,	4
55-X,	John H. Burke,	**Rockland,**	F. H. Shaw,	4
14-4,	John C. Martin,	**Rockport,**	F. A. Babcock,	1
21-6,	M. A. Peck,	**Rowe,**	- - -	-
3-13,	Daniel O'Brien,	**Rowley,**	Chas. Curtis,	1

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
279-2,	L. G. Forbes,	**Royalston,**	P. F. Richards,	5
2-12,	S. S. Shurtleff,	**Russell,**	- - -	-
4-12,	Henry Converse,	**Rutland,**	H. E. Wheeler,	5
- -	- - -	**Salem,**	Warren F. Hale,	1
- -	James H. Pike,	**Salisbury,**	H. C. Rich,	1
202-3,	C. D. Strickland,	**Sandisfield,**	- - -	-
43-2,	J. R. Holway,	**Sandwich,**	B. F. Dennison,	4
- -	Thos. E. Berrett,	**Saugus,**	T. E. Berrett,	1
4-16,	C. E. Tilton,	**Savoy,**	- - -	-
129-3,	E. R. Seaverns,	**Scituate,**	Wm. F. Ford,	4
462-J-2, Pawtucket.	John L. Baker,	**Seekonk,**	C. A. Smith,	3
10,	W. C. Morse,	**Sharon,**	J. J. Geissler,	3
26,	A. H. Tuttle,	**Sheffield,**	- - -	-
130-2,	Chas. F. Dole,	**Shelburne,**	Chas. F. Dole,	5
- -	Milo F. Campbell,	**Sherborn,**	Geo. W. Rock,	2
- -	Asa A. Adams,	**Shirley,**	A. A. Adams,	2
- -	E. A. Logan,	**Shrewsbury,**	Robt. C. Clark,	5
2-14, Cooleyville,	Nathan J. Hunting,	**Shutesbury,**	Clarence A. Haskell,	5
2632-M,	Wm. F. Griffiths,	**Somerset,**	C. Riley,	3
- -	- - -	**Somerville,**	A. B. Prichard,	2
22,	L. H. Lamb,	**So. Hadley,**	Louis H. Lamb,	5
151-23,	C. S. Olds,	**Southampton,**	C. S. Olds,	5
13, Marlborough, 3505 Fort Hill.	Harry Burnett,	**Southborough,**	H. Burnett,	5
11,	Aimee Langevin,	**Southbridge,**	J. Langevin,	5
35-3,	B. M. Hastings,	**Southwick,**	- - -	-
77-3,	A. F. Howlett,	**Spencer,**	G. Ramer,	5
20,	C. S. Taylor,	**Springfield,**	J. Alden Davis,	5
5-12,	J. T. Wilder,	**Sterling,**	J. H. Kilburn,	2
53-M,	Geo. Schneyer,	**Stockbridge,**	George Schneyer,	5
176-12,	Albert J. Smith,	**Stoneham,**	G. M. Jefts,	2
276-2 and 121-3,	Fred H. Pye,	**Stoughton,**	W. P. Kennedy,	3
- -	Wm. H. Parker,	**Stow,**	H. W. Herrick,	2
6-1,	C. M. Clark,	**Sturbridge,**	C. M. Clark,	5
- -	Seneca W. Hall,	**Sudbury,**	W. E. Baldwin,	2
46,	A. C. Warner,	**Sunderland,**	Richard Graves,	5
58-32,	R. H. Richardson,	**Sutton,**	R. H. Richardson,	5
1911-J,	Everett P. Mudge,	**Swampscott,**	E. P. Mudge,	1

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
468-W,	Thos. L. Mason,	**Swansea,**	A. E. Arnold,	3
1-320,	Fred A. Leonard,	**Taunton,**	L. W. Hodgkins,	3
78-2, 78-3 and 30,	C. A. Fletcher,	**Templeton,**	J. B. Wheeler,	5
4249-J,	Harris M. Briggs,	**Tewksbury,**	H. M. Briggs,	2
102-3 and 161-4,	Elmer C. Chadwick,	**Tisbury,**	H. W. McLellan,	2
269-5, Winsted, Conn.	Rupert E. Clark,	**Tolland,**	– – –	–
– –	T. Jesse Fuller,	**Topsfield,**	Harland S. Peirce,	1
70 and 51-2,	F. J. Piper,	**Townsend,**	G. E. King,	2
– –	Walter F. Rich,	**Truro,**	J. H. Atwood,	4
1,	Otis L. Wright,	**Tyngsborough,**	C. J. Allgrove,	2
3-6,	Clifford R. Canon,	**Tyringham,**	– – –	–
8000 and 15-2,	Geo. L. Williams,	**Upton,**	Clarence L. Goodrich,	5
101,	H. W. Phoenix,	**Uxbridge,**	Willard Holbrook,	5
58 and 455-M,	W. E. Cade,	**Wakefield,**	W. W. Whittredge,	2
9-11 and 9-23, Brimfield.	L. H. Thompson,	**Wales,**	M. C. Royce,	5
107-2,	Jas. J. Hennessey,	**Walpole,**	Philip R. Allen,	3
6,	Geo. L. Johnson,	**Waltham,**	W. M. Ryan,	2
117-13,	Joseph Dupre,	**Ware,**	F. Leissig,	5
45-23,	Delbert C. Keyes,	**Wareham,**	J. J. Walsh,	4
– –	Timothy M. Collins,	**Warren,**	Alex A. Gendron,	5
– –	C. A. Williams,	**Warwick,**	Chas. Bass,	5
12-4, Becket,	Lester G. Heath,	**Washington,**	– – –	–
– –	John C. Ford,	**Watertown,**	Van D. Horton,	2
31-3, Wayland,	Howard C. Haynes,	**Wayland,**	D. J. Graham,	2
101-R,	E. L. Wallis,	**Webster,**	C. Klebart,	5
9 and 724-M,	John P. Doyle,	**Wellesley,**	George Goodyear,	3
– –	John Holbrook,	**Wellfleet,**	Wm. H. Gill,	4
6-23,	Chas. A. Fiske,	**Wendell,**	G. E. Mills,	5
– –	Jacob D. Barnes,	**Wenham,**	J. E. Kavanagh,	1
8-23,	Arthur J. Hunting,	**W. Boylston,**	Harry E. Lowe,	5
– –	Warren P. Laughton,	**W. Bridgewater,**	O. Belmore,	4
114-3, No. Brookfield.	John H. Webb,	**W. Brookfield,**	J. H. Webb,	5
– –	Louis H. Flook,	**W. Newbury,**	Frank E. Bailey,	1
6961-J and 1504,	E. B. Jones,	**W. Springfield,**	George W. Haven,	5
8010,	B. P. Bissell,	**W. Stockbridge,**	– – –	–
92-3,	Wm. J. Rotch,	**W. Tisbury,**	H. M. Athearn,	4
119-3,	Thos. Humphrey,	**Westborough,**	George Haven,	5

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
111-Y and 111-W,	Thos. H. Mahoney,	**Westfield,**	- - -	-
44-11,	H. L. Nesmith,	**Westford,**	H. L. Nesmith,	2
148-14,	Clayton A. Bartlett,	**Westhampton,**	- - -	-
1-3,	W. F. Neal,	**Westminster,**	G. A. Sargent,	5
- -	B. R. Parker,	**Weston,**	E. P. Ripley,	2
41-21,	Frank Whalon,	**Westport,**	H. A. Sanford,	3
- -	Elmer E. Smith,	**Westwood,**	Martin Sorenson,	3
185-M and 21689,	Walter W. Pratt,	**Weymouth,**	C. L. Merritt,	3
39-14,	John H. Pease,	**Whately,**	Rylan C. Howes,	5
349-W,	C. A. Randall,	**Whitman,**	C. A. Randall,	4
1-4,	Henry I. Edson,	**Wilbraham,**	Henry I. Edson,	5
- -	John L. Brown,	**Williamsburg,**	- - -	-
34-W,	W. H. Davies,	**Williamstown,**	William Davies,	5
28-2,	Oliver McGrane,	**Wilmington,**	Oliver McGrane,	2
196-3,	Wm. F. Clark,	**Winchendon,**	Joseph W. Crocket,	5
- -	David DeCourcy,	**Winchester,**	S. S. Symmes,	2
- -	Amos S. Ferry,	**Windsor,**	- - -	-
- -	- - -	**Winthrop,**	Fred A. Whittemore,	1
- -	Frank E. Tracy,	**Woburn,**	H. V. Macksey,	2
7137, Park,	Wesley N. Avery,	**Worcester,**	H. J. Neale,	5
10-22,	Chas. A. Kilbourn,	**Worthington,**	- - -	-
69,	Geo. H. E. Mayshaw,	**Wrentham,**	H. Gilmore,	3
58-31, Barnstable,	Joseph W. Hamblin,	**Yarmouth,**	C. R. Bassett,	4

REMARKS.

1. Realizing that it is the patriotic duty of the department to be as economical as possible, the State Forester is making no new or specific recommendations and asking for no new legislation this year.

2. The efforts of the department to assist in the production of wood for fuel and its economic distribution and more common use will be given due consideration the coming year.

3. With our present high prices for spraying materials, tools, equipment and labor our appropriation for moth work will go only two-thirds as far as under normal conditions; hence the necessity for greater efficiency. Arsenate of lead costs over 3

cents a pound more than last year, and three times as much as it did four years ago. The rise in price will mean an extra expense of nearly $40,000 for this insecticide alone over last year's prices.

4. We have a large supply of stock in the State nurseries, and in order to keep up the interest in reforestation, and that individuals may take advantage of this opportunity to plant waste lands, the State Forester is authorized by the Governor and Council to sell to any person who will plant them in Massachusetts, pine transplants (small trees three to four years old) for $7 a thousand, packed and ready for shipment. The number allowed is not less than 1,000 or more than 10,000 to a person. Send orders to the State Forester, State House, Boston, Mass.

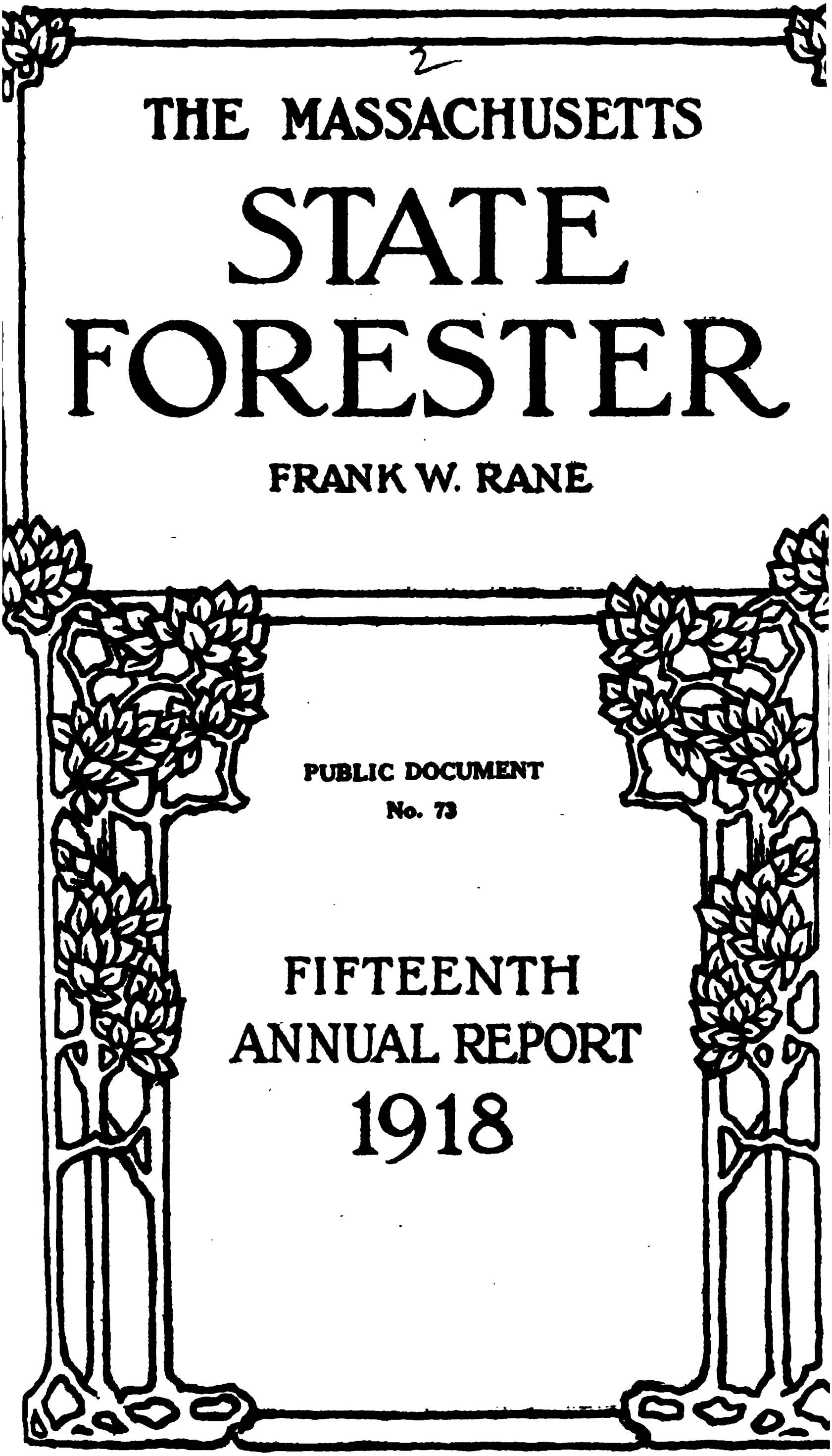
5. The redistricting of the moth work according to county lines will aid us in our co-operative work with the county agricultural agents and forest fire division men who have similar districts. Mutual assistance and understanding greatly aids in accomplishing results.

6. Were it not for the abnormal conditions existing because of the war, as referred to in that portion of this report dealing with State forests, I should make a specific recommendation that sufficient funds be appropriated to enable the planting of at least 1,000 acres of State-owned lands the coming year. As it is, I leave to the wisdom of the General Court the expediency of such action.

7. The State Forester's Department stands ready to advise and assist Massachusetts citizens in the proper development of their woodlands. It is to be hoped that in our enthusiasm to produce wood fuel at present high prices, we may not slaughter trees that rightfully should be retained for our future industries. There are plenty of woodlands in all sections of the State that are really in great need of improvement thinning. All the cordwood necessary can be derived by practicing modern economic methods, and the results will be along the line of conservation of the right kind.

F. W. RANE,
State Forester.

UNIV. CALIFORNIA



2

THE MASSACHUSETTS

STATE FORESTER

FRANK W. RANE

PUBLIC DOCUMENT
No. 73

FIFTEENTH ANNUAL REPORT

1918

Public Document **No. 73**

THE
STATE FORESTER
OF
MASSACHUSETTS

FIFTEENTH ANNUAL REPORT
1918

F. W. RANE, State Forester

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1919

PUBLICATION OF THIS DOCUMENT
APPROVED BY THE
SUPERVISOR OF ADMINISTRATION.

CONTENTS.

PAGE

Report of cranberry committee, ... 9
Organization, ... 10
General forestry, ... 12
Reforestation, ... 14
Expenditures for 1918 on State forests, ... 17
Tree planting in 1918, ... 18
Moth thinning work, ... 19
State Fire Warden's report, ... 22
Lectures and addresses, ... 27
State highway work, ... 28
Distribution of supplies, ... 29
Financial statements, ... 31
Statement of receipts, ... 34
Financial summary of moth work, ... 36
List of forest wardens and local moth superintendents, ... 44
Summary of recommendations, ... 54

The Commonwealth of Massachusetts.

FIFTEENTH ANNUAL REPORT OF THE STATE FORESTER.

To the General Court.

It has been our aim and our desire to make this report as concise as possible. In conformity with the act of last year, it is stripped of all the fullness of detail which has characterized former reports submitted by this department, and contains only a brief summary of the year's work, together with such recommendations and suggestions as we believe may well engage the serious attention of the General Court. We are confident that forestry has not only come to stay in Massachusetts, but is bound to become an increasingly important factor in developing and sustaining the economic strength of our Commonwealth.

The history of forestry developments, activities and achievements yields "comfort and good cheer" to those who recognize the importance of making provision for an adequate supply of timber in the future. While the progress we have thus far attained is challenging attention, we believe we can ill afford to further postpone the policy of planting and managing on a much larger scale than has thus far obtained.

There is an added incentive to the enlargement of this enterprise at this time. With the close of the World War we find ourselves confronted by problems that are already engaging the serious attention of the greatest minds in the public life of the nation, and the question most frequently discussed, and the one the finding of a correct answer for which is of the most vital importance to us as a people, is how to reabsorb into our social and industrial life that vast army of young Americans who have been fighting to make the world a decent place to live in. In the immediate future thousands of these boys will be seeking employment, and it should be our duty to see to it that every agency which may be advantageously employed should be used to meet the situation.

The State Forester has now under his control more than 15,000 acres of land which have been purchased by the State Forest Commission and turned over to him for reforestation and management. He also has in the forest nurseries a sufficient number of trees to plant thousands of acres of these lands. I therefore desire to urge upon the General Court the wisdom of making an appropriation sufficient to begin the work of developing these State forests. Such action by the General Court will enable this department to furnish healthy occupation to many of these men whose welfare should be our greatest concern, at the same time carrying out the policy, to which the State is committed, of establishing splendid State forests.

The discovery a few years ago of the white pine blister rust, and the prominence given it by the press and through other mediums, caused considerable anxiety on the part of those interested in the promotion of forestry, many being made to believe that the planting of white pine would have to be discontinued. The investigations undertaken and prosecuted with great vigor by the Federal government, supplemented by the efforts of many of the States, have finally resulted in our obtaining a fairly definite knowledge of how widespread the disease is, and a more comprehensive idea of how best to control it.

At its meeting held at the State House on November 11 and 12, the North American Committee, made up of representatives from a dozen or more leading States and Canada, after discussing the subject nearly two days, adopted a resolution which declared in substance that while the disease should be considered dangerous, and that remedial measures should be adopted, it is not sufficiently menacing to stop the planting of white pine. In Massachusetts the responsibility of controlling this disease by statute rests upon the Department of Agriculture, the State Forester co-operating.

During the year the gypsy moth work has been continued with unabated energy and with encouraging results. Notwithstanding the difficulty in securing competent labor, and the advanced prices of materials used in connection with this work, we succeeded in making satisfactory progress. In the prosecution of this work during the past year especial attention was given to woodland thinning operations. As is well known, our Massachusetts woodlands are commonly a mass of crowded, choked growth, with many more trees struggling for existence than can under such conditions reach maturity. Also, owing to the depredations of the gypsy moth, many trees are found dead or in a dying condition. A judicious thinning of such forests is not only beneficial to the remaining trees by giving them more freedom of growth, but also makes spraying operations and other methods commonly employed in moth suppression more easy to be carried on.

With the coal shortage the demand for wood for fuel was very great, and prices at once became very high. To get wood fuel at any price seemed to be the idea. It was not only a question of the domestic supply, but factories working on war contracts had to resort to wood fuel in many cases.

It was impossible to direct the wood-cutting operations as heretofore, although there were plenty of woodlands needing judicious thinning. Wood for fuel was wanted immediately, and the price proved alluring to owners, and much wood was cut, regardless of future results.

Some good work, however, was done, but as labor was in great demand, and capital was almost impossible to get, as the production of food seemed to command it, no very effective and far-reaching policy could be established.

During the present season a greater amount of constructive work has been possible. The fact that dependence could be placed upon wood fuel to help out strained fuel conditions has caused people to lay in an auxiliary supply. Also, the better prices have interested woodland owners in cutting more wood for the market, and particularly in making improvement cuttings.

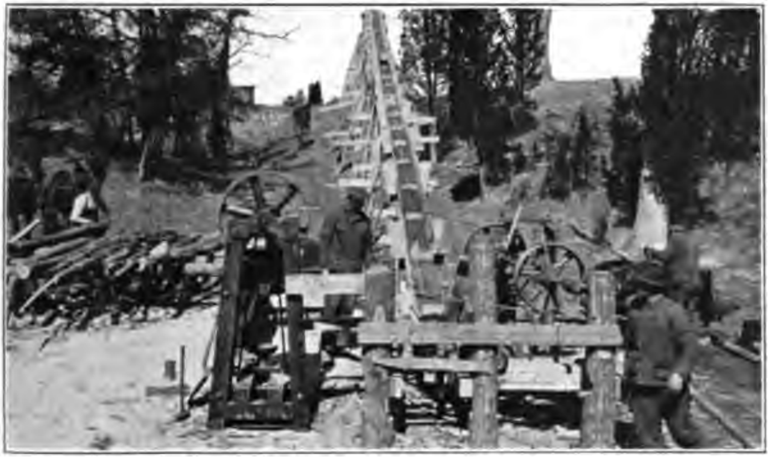
This department has encouraged towns and cities to purchase portable wood-sawing machinery, which is being used quite commonly in many sections of the State. In Middlesex County probably the largest number of portable wood-sawing machines are at work this winter. These machines cut the wood into 12-inch, 16-inch and 2-foot lengths, which are the usable sizes. Thus far, wherever wood in these sizes is to be had, the demand exceeds the supply. Four-foot wood, while it is the standard unit in dealing with wood fuel, nevertheless is not the size that consumers desire for domestic use, and it is believed it will pay us to go one step further and cut our wood into the smaller sizes if we expect to continue to find the desired markets for our products. For brick factories, manufacturing concerns, etc., who can use the 4-foot lengths, of course that size may continue to be the standard unit.

By cutting into the smaller lengths, also, almost everything can be used, hence there is very little waste.

One of the great needs, however, in dealing in short wood is some standard legal measures for wood to be sold in entire contents or so-called bulk-thrown wood. While a cord of wood is designated as 4 feet high, 4 feet wide and 8 feet long, or 128 cubic feet, when this same cord is cut into shorter lengths and then piled, it invariably shrinks in measurement, as it packs more closely than when in the longer lengths. This department has made some careful measurements, and is prepared to submit the data for establishing a definite law covering this point. The Sealer of Weights and Measures is co-operating in this work.

If from our past experience we may be able to encourage a better and more economic use of fuel wood at reasonable prices, it is believed we shall have taken the proper step toward getting forestry established on a far more successful basis. Fuel wood is a by-product of the forest, but it has real potential value, and with better methods of distribution and utilization a permanent solution of the problem will be reached.

The invasion of the cranberry bogs in Plymouth and Barnstable counties by the gypsy moth has been referred to in previous reports. The importance of protecting this great industry from the peril of this pest was quickly recognized, and prompt action taken. This department, working in co-opera-



A wood-sawing machine, equipped with an endless chain carrier, which piles the wood at a convenient distance from the machine. The machine in the left center is a splitter. A 10 horse-power kerosene engine is the source of power. One of the experimental machines being used by the State Forester's department in the town of Dover.

The type of woodlands that the State Forester is encouraging owners to operate for use on the present market. A thousand cords were cut out of this moth-depleted stand last winter. Only the better trees were left, and at the present time these trees are retaining their foliage in spite of the gypsy moth. The photograph shows the committee of agriculture of the General Court on an inspection trip.

tion with a committee of the Cape Cod Cranberry Growers' Association, has been diligently engaged in carrying on operations of a protective nature. This work has consisted mainly in removing the tree growth from the land immediately adjacent to the bogs, thereby reducing in large measure the possibility of infestation. While the work thus far accomplished is encouraging, it is felt that still greater efforts will be required before the pest in this region is brought under complete control.

It is the purpose of the State Forester to give this protective work the closest attention, and while it would be difficult indeed to predict what may be the net result of our co-operative effort to protect the cranberry industry from the ravages of the gypsy moth, all things considered, if this salvage work be even 50 per cent. efficient, we shall certainly not have labored in vain.

That the situation is regarded as serious by the cranberry growers themselves is evidenced by the following report of their committee just submitted to the State Forester.

REPORT OF CRANBERRY COMMITTEE ON MOTH WORK.

The Infestation of Cranberry Bogs by Gypsy Moths.

The committee have made a more careful inspection than has been heretofore done. Some ten weeks have been spent on the work, and we find the infestation covers to some extent the whole cranberry industry.

We would call attention to the towns of Rochester and Plymouth and the lower cape towns of Barnstable, Mashpee, Harwich, Dennis and Brewster, where the most damage has been done.

There are bogs badly injured at the present time that will take some years to recover. The peculiar situation of some bogs, being surrounded by hills covered with a growth of oak, will be very hard to handle.

From every viewpoint bog infestation will be very heavy for some time to come, and the situation, as viewed by us, is very serious and will take the co-operation of the State, towns and growers to save the cranberry industry from the gypsy moth pest.

J. M. BUMP, *Chairman.*
JAMES J. WALSH.
C. A. DRISCOLL.
JOHN W. CHURCHILL.
I. C. HAMMOND.
WALTER F. HOLMES.

The prevention of forest fires continues to be one of the most serious problems with which the department is obliged to contend. Past experience makes it clear that to deal more effectively with this evil more stringent rules and regulations governing the disposal of slash or brush must be adopted. The State Fire Warden has given the subject the most rigid investigation, and as will be noted in his report to the State Forester he recommends remedial measures.

ORGANIZATION.

There have been many changes in our department during the year, owing particularly to the war. The changes have been mostly among our foremen and observers. We print here our honor roll of enlisted and drafted men.

HONOR ROLL.

Charles R. Atwood,	20th Engineers.
Lester W. Bryan,	20th Engineers.
Clifford N. Churbuck,	Aviation Corps.
Earl Flebut,	101st Engineers.
William LaPoint,	Ambulance Corps.
Guy W. Lucas,	Camp Devens.
Frank G. Michelson,	Infantry.
Charles Palmer,	Coast Artillery.
William E. Palmer,	Engineers.
Joseph L. Peabody,	20th Engineers.
Burr Powers,	Quartermaster's Corps.
Frederick R. Stone,	Infantry.
Arthur Stuart,	Infantry.
Thornton G. Taylor,	S. A. T. C., Massachusetts Agricultural College.
John E. Wheeler,	F. A. C. O. T. S., Camp Zachary Taylor.
Ainsley C. White,	United States Navy.
Raymond T. Wilder,	20th Engineers.
Raymond J. Zilch,	United States Navy.

The present organization of the department is as follows: —

GENERAL STAFF.

F. W. RANE, B.Agr., M.Sc.,	State Forester.
C. O. BAILEY,	Secretary.
ELIZABETH HUBBARD,	Bookkeeper.
ELIZABETH T. HARRAGHY,	Stenographer.
JENNIE D. KENYON,	Stenographer.
MABEL R. HAMNETT,	Clerk.

General Forestry.

H. O. Cook, M.F.,	Assistant forester in charge.
J. R. Simmons, B.Sc.,	Reforestation work.
James Morris,	Assistant.
Eben Smith,	Superintendent, Barnstable Nursery.
J. A. Palmer,	Superintendent, Amherst Nursery.
H. H. Chase,	Field foreman.
Fred W. Parker,	Field foreman.
John H. Saxton,	Field foreman.
Avery Gardner,	Field foreman.

Moth Work.

George A. Smith,	Assistant (equipment, accounts, etc.).
Paul D. Kneeland, M.F.,	Assistant (woodlands, products, etc.).
Guy W. Lucas, B.Sc.,	Assistant.
Herbert E. Henshaw,	Assistant.

District Moth Men.

1. Saul Phillips, Beverly.
2. Wm. A. Hatch, Marlborough.
3. C. W. Parkhurst, Foxborough.
4. W. F. Holmes, Wareham.
5. Harry B. Ramsey, Worcester.

Forest Fire Prevention.

Staff.

M. C. Hutchins,	State Fire Warden.
Josepha L. Gallagher,	Clerk.

District Forest Wardens.

1. Jos. J. Shepherd, Pembroke.
2. Miner E. Fenn, Needham.
3. James E. Moloy, Woburn.
4. John P. Crowe, Westborough.
5. Albert R. Ordway, Westfield.

Observers.

John Condon, North Harwich.
Joseph Jenkins, Barnstable.
W. I. Moody, West Falmouth.
Walton F. Raymond, Bournedale.
F. L. Buckingham, Kingston.
D. M. Smith, Waltham.
S. Edward Matthews, Middleborough.
John H. Montle, Fall River.
Everett Short, Rehoboth.
Chas. F. Kimball, Hanson.
Edward D. Sprague, Hingham.
C. H. Baker, Sharon.
Mrs. Allen Keniston, Martha's Vineyard.
F. R. Stone, Sudbury.
John H. O'Donnell, Wakefield.
C. E. Blood, Chelmsford.
Thomas Magovern, Charlton.
Frederick W. Oliver, Georgetown.
Caplis McCormick, Manchester.
John G. Purington, Mendon.
John Roche, Westborough.
James Maley, Princeton.
Wm. E. Taylor, Warwick.
K. W. Burrows, Pelham.
George B. Sherman, Brimfield.
Charles Putnam, Westfield.
N. C. Woodward, Shelburne Falls.
H. H. Fitzroy, Savoy.
Elmer Hunt, Chester.
John E. Curtin, Tolland.
Clayton Bunt, Great Barrington.
Robert Miller, Pittsfield.
Harry George, Williamstown.
George E. Walker, Ashby.
Alton B. Ellis, Acushnet.

General Forestry.

The activities of this branch of the State Forester's department are pretty thoroughly covered in the following tables, but it is of interest to call attention to certain parts of the data there presented.

On account of the shortage of labor, especially because of the loss of trained foremen who enlisted in the service, less work than usual was done on the reforestation lots and the State forests. We have, however, planted 10 new plantations and finished reforesting 2 others which were uncompleted in previous years, a total acreage of about 300, requiring the use of 200,000 trees. At the same time we carried on the maintenance work of brush-cutting and replanting on 11 other lots, cutting brush on 100 acres and planting 57,000 trees.

In spite of the labor conditions our nursery work was carried on to its normal capacity. In fact, at the Bridgewater State Farm, where we are accustomed to use the labor of inmates, the shortage of this class of labor was so great that we could not obtain any, and we were obliged to hire outside help to carry on the nursery. We had on hand at the commencement of this year an unusual number of four-year transplants of white and Scotch pines, with the prospect that we would be able to use but a small portion of them in our own work. Although conditions for selling forest-planting stock at best were not favorable, we were enabled through considerable advertising and other methods of salesmanship, in which the entire department joined, to dispose of nearly 600,000 trees to 196 purchasers. By this campaign we turned into the State treasury nearly $4,000 on the sale of stock which otherwise must have gone to waste. Although this method of disposing of our stock was new to the men in this branch of our work, and the cause of a great deal of extra work, it was efficiently carried out, and our customers were much pleased with the stock which they received and the promptness with which it was shipped. If the stock shipped for our own use and that of other State departments is valued at the same figure as that sold, the total value of the nursery product would be $10,000.

The product from thinnings in process of manufacturing into fuel wood. These are piles drawn from the more inaccessible and rocky portions of the woodlot during good sledding conditions in the winter, and are used as an auxiliary supply near the mill in summer. One thousand cords are estimated as the product of this woodlot thinning from 100 acres.

Woodlots like this can now be operated by improvement thinnings, and the product may make a profit, or at least pay for the expenditure and improve the future stand. There are thousands of acres that are in a similar condition, due to fires having run through them or gypsy or brown-tail moth devastation. Two years ago the products from these woodlands could not have been given away, but now may be utilized to advantage. Even the dead trees, if cut in full lengths, may be sawed into firewood and by virtue of the dry condition prove desirable.

If war caused a slackening of work on some lines, in others it has increased our activities. This is particularly true of the examinations of private woodlands, which for the past two years have been made at nearly double the old rate. Reference to the table will show that most of these examinations are either for thinnings or for estimates for operating, reflecting the demand for lumber and cordwood. With a return to more normal conditions we hope that a larger proportion of the owners will want our advice and assistance along lines of reforestation.

As work on State plantations was curtailed, so was work on State forests. At Otter River we planted 55,000 trees, transplanted 100,000 seedlings in the nursery, cleaned up the fire lines along the railroad and electric car line, thinned out a few acres of woodland, and cleared about 30 acres of brush in preparation for planting. The headquarters house and barn have been reshingled.

At Myles Standish State Forest the boundary fire line, 22 miles in length, has been mowed over, and several additional miles of old wood roads have been brushed out and made passable for automobiles and teams. In some cases it was necessary to do some grading and filling in order to make the roads usable, but it is really quite remarkable what excellent highways are created by simply clearing away the brush from these old wood roads. No planting, except a small experimental area of red pine, was accomplished, and no trees were transplanted in the nursery. Some improvements have been made in the buildings. The barn has been painted, and part of the foundation renewed. The care-taker's house has had a small addition and a new chimney built onto it.

All the work on these State forests, whether it be woodchopping, planting, carpentry or masonry, is done by the care-taker and his one or two assistants.

In addition to the work on the plantations and State forests we have supervised planting and thinning work on three or four private estates, and have also set out for the Highway Commission a belt of pines on both sides of the State road between Nantucket and Siasconset, — 5 miles in length.

The third edition of our reforestation bulletin having been exhausted, we have prepared a new edition, which is now in the hands of the printers. For the first time, we have in one bulletin all the forest laws of the Commonwealth, including forestry, forest fire and gypsy moth. The bulletin on "The Forests of Plymouth County," which has been some time in the course of preparation, was issued early in the year.

REFORESTATION.

NEW WORK.

[R. p. = red pine; w. p. = white pine.]

Number.	NAME.	Town.	Area (Acres).	Trees.	Acres brushed.
152	LeClear,	Brewster,	20	2,000 r. p.	20
				7,000 w. p.	-
139	Perry,	Falmouth,	18	7,000 r. p.	9
149	Estabrook,	Lunenburg,	-	2,000 w. p.	-
150	Estabrook,	Fitchburg,	-	3,000 w. p.	-
158	Fullam,	North Brookfield,	12	10,000 w. p.	-
159	Fullam,	North Brookfield,	50	15,000 w. p.	-
				7,000 r. p.	-
143	Town,	Berkley,	12	7,000 w. p.	-
135	Smith,	Barnstable,	10	10,000 r. p.	-
				6,000 r. p.	-
142	Leonard,	Raynham,	16	6,000 w, p.	-
				11,000 r. p.	-
124	Hansen,	Marlborough,	100	11,000 w. p.	20
138	Morse,	Warwick,	6	2,000 w. p.	-
140	Snow,	Conway,	9	3,000 w. p.	-

MAINTENANCE.

[R. p. = red pine; S. p. = Scotch pine; w. p. = white pine; s. = spruce.]

Number.	NAME.	Town.	Area (Acres).	Trees.	Acres brushed.
113	Perry, W.,	Medfield,	28	4,000 r. p.	-
				1,000 r. p.	-
5	Hodgman,	Montague,	20	10,000 S. p.	-
84	Civic League,	Nantucket,	80	2,000 w. p.	-
100	Harrington,	Westminster,	100	15,000 w. p.	30
35	Creamer,	Peru,	19	4,000 s.	-
118	Brown,	Marlborough,	30	-	15
119	Brown,	Marlborough,	45	-	35
134	Crocker,	Barnstable,	30	15,000 r. p.	-
80	Dean,	Rutland,	40	-	5
136	French,	Rutland,	26	-	2
75	Robertson,	Oakham,	75	4,000 w. p.	-
31	Weeks,	East Sandwich,	23	2,000 r. p.	-
30[1]	Lowe,	Colrain,	500	-	-
90[1]	Chestnut Hill,	Spencer,	200	-	-
117	Gaskill,	Upton,	-	-	10

[1] These lots were examined for weevil.

List of Examinations by Counties.

County.	Number.	Acres.
Middlesex,	30	965
Suffolk,	2	203
Worcester,	8	590
Hampden,	7	936
Franklin,	5	310
Plymouth,	10	190
Bristol,	3	160
Berkshire,	9	1,490
Essex,	20	3,710
Norfolk,	10	286
Barnstable,	2	80
Hampshire,	2	62
Totals,	108	8,982

List of Examinations by Subjects.

Subject.	Number.	Acres.
Thinning,	32	4,129
Planting,	10	1,140
Insect and diseases,	12	372
Operating and estimating,	29	2,157
General,	11	1,109
Damage claims,	8	75
Shade trees,	6	-
Totals,	108	8,982

Stock sold to Private Owners.

Species.	Class.	Number.
White pine,	4-year transplants,	381,000
Scotch pine,	4-year transplants,	153,000
Red pine,	4-year transplants,	26,000
Spruce,	4-year transplants,	34,000
Austrian pine,	4-year transplants,	5,000
Total,		599,000

Stock used by Other State Departments.

Species.	Class.	Number.
White pine,	4-year transplants,	63,000
Scotch pine,	4-year transplants,	3,000
Red pine,	4-year transplants,	1,000
Red pine,	Seedlings,	30,000
Arbor vitæ,	4-year transplants,	1,500
Spruce,	4-year transplants,	1,000
White pine,	Seedlings,	300,000
Hemlock,	5-year transplants,	1,000
Total,		401,000

Stock used by Forestry Department.

Species.	Class.	Number.
White pine,	4-year transplants,	237,000
Scotch pine,	4-year transplants,	20,000
Red pine,	4-year transplants,	100,000
Spruce,	4-year transplants,	27,000
Total,		384,000

INVENTORY OF NURSERY STOCK.

SPECIES.	5-Year Transplants.	4-Year Transplants.	3-Year Transplants.	2-Year Seed Beds.	1-Year Seed Beds.
White pine,	295,000	785,000	1,184,000	411	151
Scotch pine,	230,000	218,000	45,000	76	50
Red pine,	-	160,000	325,000	-	-
Austrian pine,	-	24,000	-	-	-
Loblolly pine,	-	-	-	2	50
Banks pine,	-	-	-	20	-
Bull pine,	-	35,000	-	-	-
Norway spruce,	-	273,000	-	-	-
Red spruce,	-	-	-	-	-
Hemlock,	1,400	-	-	-	-
Arbor vitæ,	12,000	-	-	-	-
Douglas fir,	10,000	-	-	-	-
European larch,	-	-	10,000	-	12
Totals,	548,400	1,495,000	1,564,000	509	263

EXPENDITURES FOR 1918 ON STATE FORESTS.

In accordance with the provisions of section 3, chapter 720, Acts of 1914, the State Forester herewith gives a statement of the expenditures on each State forest for the past year.

Otter River State Forest.

Planting,	$981 90
Brush cleaning,	456 23
House and miscellaneous expenses,	437 34
Nursery work,	389 30
Land purchase,	328 00
Fire lines and roads,	188 07
	$2,780 84
Less amount received for wood sold,	50 00
	$2,730 84

Savoy State Forest.

Land purchase,	$679 53
Less amounts received for sale of barn and hay,	97 00
	$582 53

Harold Parker State Forest.

Land purchase,	$971 16
Less amount received for hay sold,	4 00
	$967 16

Myles Standish State Forest.

Fire lines and roads,	$1,329 25
House and miscellaneous account,	232 22
	$1,561 47
Less amount received for supplies sold,	19 48
	$1,541 99

TREE PLANTING IN 1918.

A total of 564,210 trees of white and Scotch pine, with a few thousand of miscellaneous stock, was planted in the spring of 1918 throughout the State. This stock was sold to the public from our State nurseries, at an average price of $7 per thousand.

These trees were distributed through the State in the following list of 115 towns and cities: —

Amherst.
Arlington.
Athol.
Attleboro.
Auburndale.
Ayer.
Barnstable.
Beverly.
Billerica.
Bolton.
Boston.
Bourne.
Boxborough.
Cambridge.
Carlisle.
Cohasset.
Concord.
Dana.
Danvers.
Dedham.
Dennis.
Douglas.
Dover.
Easthampton.
Fitchburg.
Foxborough.
Framingham.
Freetown.
Gardner.
Georgetown.
Gloucester.
Granby.
Great Barrington.
Greenfield.
Greenwich.
Groton.
Groveland.
Hadley.
Harvard.
Haverhill.
Hingham.
Holliston.
Holyoke.
Hubbardston.
Hudson.
Lakeville.
Lancaster.
Lawrence.
Leominster.
Lexington.
Lincoln.
Littleton.
Longmeadow.
Lowell.
Lynn.
Mansfield.
Marion.
Marlborough.
Marshfield.
Medfield.
Medford.
Methuen.
Middleton.

A mixed hard and soft wood stand of 30 acres at Marion. About 300 cords of oak have been cut out, leaving the pine and some hard woods. In a few years a further cutting of oaks will be made when the stand will become entirely moth resistant. Not only are the hard woods adaptable for sale at the present time, when fuel wood is needed, but the remaining forest has a far greater potential value, as white pine is the species most largely sought after. The elimination of the gypsy moth, the improving of the forest stand, and the utilization of the hard woods at a time when the product is much needed, are all thus accomplished. This is a valuable shore property.

A pile of 16-inch fuel wood cut and split ready for market. This is a convenient size, suitable for either the grate, hearth fire or furnace. There are about 100 cords in this pile, basing a cord on wood equivalent to 4 feet high, 4 feet wide and 8 feet long. This is the wood product from thinnings shown in accompanying cuts in this report.

Millis.
Montague.
Natick.
Needham.
New Bedford.
Newbury.
Newburyport.
Newton.
Northampton.
North Attleborough.
Northbridge.
North Brookfield.
Norwell.
Orange.
Orleans.
Oxford.
Palmer.
Peabody.
Pepperell.
Plymouth.
Quincy.
Rockland.
Rockport.
Rowley.
Rutland.
Sandisfield.
Sandwich.
Scituate.
Sherborn.
Shirley.
Shrewsbury.
Southwick.
Spencer.
Sudbury.
Taunton.
Tisbury.
Townsend.
Truro.
Waltham.
Ware.
Wareham.
Watertown.
Wayland.
Wellesley.
Westborough.
West Bridgewater.
West Brookfield.
Westford.
Weston.
Williamstown.
Winchendon.
Worcester.

Moth Thinning and Wood Utilization Work.

Utilization and Co-operative Operating Work.

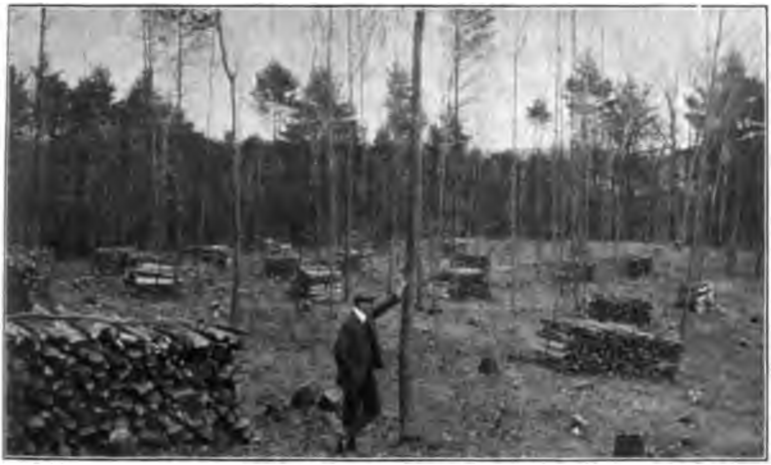
During the past year this work has gone on with the added stimulus of high prices for forest products. We have been unable to do as much as in some past years, however, due to the great difficulty in obtaining labor. A table of the operations carried on during the past year is appended. Fifty-three thousand dollars were expended on these operations during the past year, and the total receipts from products sold during the past year were $64,000. A large number of examinations were made, covering over 4,000 acres, where advice as to products and utilization was given. Two bulletins were published, one on wood fuel and another on the utilization of forest products in Massachusetts. Four talks on utilization subjects were made during the year at various gatherings. It is also estimated that several hundred letters in direct response to utilization and forestry questions were written, and it is known that a number of these resulted in financial benefit to the enquirer. Aid was also given to quite a number of owners of forest products in selling their wood and lumber, and we are very much pleased to do that kind of practical work for the farmers of the State.

Cordwood and Wood Machines.

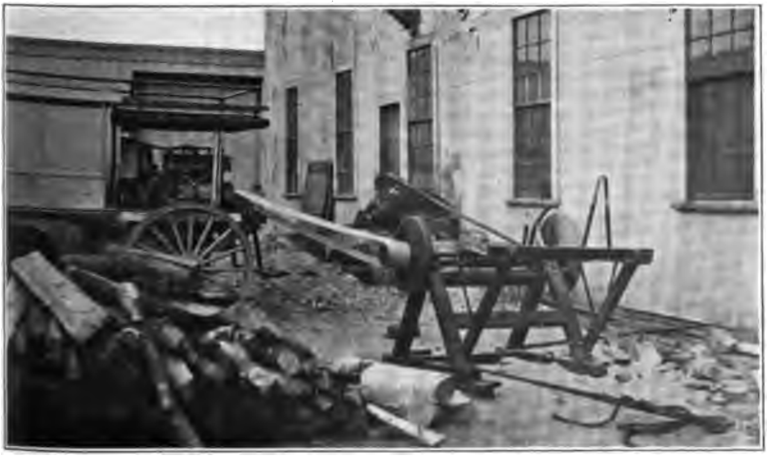
The most important single development during the past year was the cordwood situation as related to the general fuel situation, and the purchase and operation by this department of two machines for the production of cordwood as recommended by the wood fuel committee. These machines are for the purpose of cutting cordwood directly into the used (or fitted) lengths from the whole tree or from the log without going through the extra motions of first cutting into 4-foot lengths. These machines have been in operation most of the year, and have proven very successful, although we have had to learn a good many things about the business and they have not proven as financially profitable as we had hoped. However, with the experience gained we expect that they will be a great contribution to the production of cordwood by modern methods. If the market for wood continues favorable, we expect to keep them constantly in operation throughout the next year, as we now have trained men to operate them. We expect shortly to publish a bulletin describing these machines in full, together with a detailed account of costs, results, etc. They do result in a great saving of labor, as more than half the processes of converting the tree into fuel for domestic use are saved by their use, and we believe that their more general adoption is only a question of development.

War Work.

The utilization section was engaged during the past year in direct or indirect war work probably more than any other division of the department. This was recognized by the draft boards, who exempted some of the men on the grounds of occupation. We had several contracts for furnishing wood to the government, which we did at approximately cost, thus saving the government considerable money. We also were busily engaged on the wood-fuel problem throughout the year, to the exclusion of other work, and directly produced nearly 5,000 cords, and helped by advice and encouragement to the owners in the production of a good many thousand more. We also established last February, at the time of the great fuel



A hardwood thinning near Haverhill, in which the natural moth-food trees have all been removed. Most of the cord wood here cut was oak and two-thirds of it was practically dead. The species remaining are largely pine, maple, ash and hickory. This product at the present time is worth practically three to four times its former value on the lot. While the labor for cutting seems high, it is not when compared with the price of the product.



An auxiliary wood-sawing machine connected with a high-power spraying machine. Many towns and cities own the spraying machines, and by an additional expenditure of less than $100 a very practical wood-sawing machine may thus be had. Automobile engines may also be utilised as power for driving similar machines.

shortage, a wood exchange whereby we attempted to put the owner of cordwood in direct touch with the user. It was then a frantic scramble, as many industries, buildings, etc., were practically without any kind of fuel to carry them over the extreme weather. By our aid several mills were furnished with thousands of cords of wood, also office buildings, homes, and other users, and the producers received a direct market for their product without middlemen, which could not otherwise have been done. We are still cutting more or less as a clearing house for wood, although we are not going into the business very extensively as the market is being taken care of by the regular channels. We consider our work last February to have been merely emergency work.

Chestnut.

One of our greatest problems is the utilization of chestnut. The blight is spreading rapidly, and it looks as if a few years at the most would result in the elimination of that species from the State. It is therefore necessary that the growing chestnut be cut and marketed as rapidly as possible, and at a profit. This situation applies especially to the western part of the State, where the gypsy moth is not common. We are devoting a good deal of our energies, along utilization and operating lines, to the chestnut at present, and hope to be able to do considerably more than we have done.

CO-OPERATIVE OPERATIONS.

Name.	Location.	Character of Operation.
American Forestry Company,	Framingham,	Sawmill.
John W. Baker,	Saxonville,	Sawmill.
Francis R. Bangs,	Wareham,	Cordwood.
H. W. Bennett,	Marion,	Wood machine.
Cochituate forestry account,	Wayland,	Sawmill and cordwood.
D. C. Brewer,	Harvard,	Sawmill and cordwood.
F. S. Goodwin,	Dover,	Wood machine.
Lawrence Minot,	Wareham,	Cordwood.
Wayne E. Stiles,	Huntington,	Sawmill and cordwood.
G. F. Schwartz,	Dennis,	Cordwood and brush.
H. C. Mulligan,	Wayland,	Sawmill and cordwood.

The State Fire Warden's Report.

Mr. F. W. Rane, *State Forester.*

Sir: — In compliance with your request, and in accord with the provisions of chapter 722, section 2, Acts of 1911, I beg to submit the following report of the work accomplished by this branch of the department this year.

With the exception of three weeks during the last of April and the first of May, the season has been a favorable one. During this period of drought, which occurred before the vegetation had started and at a time when unusually extensive wood and lumber operations had been carried on, the damage was very large. Over 300,000 cords of wood had been cut, covering an area of 30,000 acres; 185 portable sawmills had been in operation during the year. All this in addition to the previous cutting, with the slash and brush left on the ground, made fire conditions that were extremely hazardous. Our reports show that we had over 1,800 fires during this period, causing a loss in wood and lumber of $38,000; buildings, $46,000; and forested area, $90,000.

It is very evident that if forest fires are to be controlled in Massachusetts, a more satisfactory disposition must be made of the slash and brush from wood and lumber operations. In nearly every operation carried on in the State during past years the brush and slash has remained on the ground, no disposition having been made of it, with the exception of cleaning a 40-foot strip along highways and railroad lines. The present slash law, which has been in operation for the past three years, is not accomplishing the desired results and should be amended by providing for a cleared strip at least 100 feet wide around the cuttings, so that men fighting fires will have some chance of holding them within bounds. The State Fire Warden and his assistants, together with the town forest wardens, should be responsible for the enforcement of the law, and the penalty should be made strong enough so that the operators or owners will find it to their advantage to comply with it.

Owing to the fact that a large percentage of our woodland lies within the smaller towns in the State, and the burden of taxation for extinguishing fires in many of them has been extremely heavy in past years, it seems but fair that financial assistance should be given these small towns, if we are to preserve the present forested area. I feel that if a town with a valuation of $1,250,000 or less has expended one-tenth of 1 per cent. of its valuation for extinguishing forest fires, it should be reimbursed by the State one-half of any additional expense for fighting fires, the total amount to be paid by the State to any town in any one year not to exceed $250.

We have maintained 35 observation stations during a portion of the year, 20 of which were in operation during the entire season. The accuracy and promptness of the observers in reporting fires, especially those who have been in the service for some years, has been extremely gratifying, and many words of commendation have been received from forest wardens and selectmen, showing the efficiency of this part of the service.

Owing to the large number of forest wardens and deputies entering the United States service, it has been practically impossible to keep our town organization up to the standard; many towns have been unable to get sufficient help to extinguish even small fires. The importance of having motorized equipment for getting to fires promptly is being demonstrated more and more each year. Seventy-five towns have some form of motorized equipment, and 150 towns have sufficient equipment for handling any ordinary fire.

A 48-foot tower with a 10 by 10 foot room at the top, equipped with a ladder, has been erected on Ragged Mountain in the town of West Brookfield. This tower was purchased last year and a portion of the construction work was done, but, owing to lack of appropriation, it was not completed until July of this year. It was necessary to install 3 miles of telephone line to connect with the New England Telephone and Telegraph Company at West Brookfield. This tower was not placed in operation this year on account of favorable fire conditions.

A new 48-foot tower has been erected on the summit of Mendall Hill in the town of Acushnet. This tower has a 10 by 10 foot room, and is equipped with stairs. It covers several thousand acres of valuable woodland in the surrounding towns. The towns of Acushnet, Rochester, Freetown, Mattapoisett and Fairhaven contributed $900 towards the cost price of the tower. One-half mile of telephone line was installed connecting with the New England Telephone and Telegraph Company at Acushnet.

For the past six years the State has maintained a forest fire tower on Robbins Hill, Chelmsford. This was a small windmill type of tower with a ladder. It has been known for some time that a much higher and heavier tower was needed at this point, in order to cover the forested area to better advantage, and last winter we asked the towns of Chelmsford, Westford, Tyngsborough, Dunstable, Dracut, Tewksbury, Billerica, Carlisle and Littleton to raise at their annual town meetings from $100 to $300 each for the purchase of a suitable tower with stairs at this point. This request was received very favorably by each town and $1,750 was raised. We therefore purchased the summit of Robbins Hill and erected a 75-foot tower, with a 10 by 10 foot room at the top, equipped with stairs. This tower was completed September 1.

A new 45-foot tower has been erected at the summit of Holcomb's Hill in Chester. This is a light-weight tower, with an 8 by 8 foot room at the top, and is equipped with a ladder. I think this station commands a more wonderful view of forested area than any of the other 35 stations. The erection of the above stations practically completes the observation system of the State. It will be necessary, however, to replace one or two more of our small windmill towers by higher and heavier ones, and it may also be necessary to install two or three substations to take care of some local area that is not satisfactorily covered at this time. I am in hopes that we can arrange to erect a new tower on Grace Mountain, Warwick, where we have maintained a 40-foot windmill tower, with no building for the protection of the observer, for the past seven years.

The Rehoboth, Barnstable, Bourne, Fall River, Mount Everett and Tolland towers were painted this year.

We have had during the year, 799 railroad fires, as follows: Boston & Albany, 224; Boston & Maine, 131; New York, New Haven & Hartford, 397; and the Central Vermont, 47. These fires burned over an area of 9,152 acres, causing a damage of $113,000 and a cost to extinguish of $13,000. This is the largest railroad fire loss we have had in several years, and a large part of it was due to a fire which occurred in Marshfield in April, when several buildings were destroyed, causing a damage of $45,000.

The front ends and ash pans of over one thousand locomotives were inspected during the season, and aside from some minor defects, were found in very good condition. The tramp locomotives coming in from other States where they are not subject to rigid inspection have caused a large number of fires. We hope that fires from this cause will be lessened the coming year, through an agreement with the Federal Forest Service and the Railroad Administration Department. The railroads have experienced considerable trouble in procuring sufficient help to keep their rights of way cleaned and burned, and the result is that we shall have a large number of grass fires to contend with during the coming spring.

Over 20,000 permits for burning brush were granted this year, and several arrests were made of parties burning brush without permits. A large number of these parties were allowed to settle the cost caused in extinguishing the fires, while others were convicted and fined. During the early spring 10,000 cloth and cardboard fire notices were distributed throughout the Commonwealth. These were posted in public places and throughout the forested area where people were liable to congregate.

The co-operation between this department and the Federal department has been very satisfactory. In addition to our regular Federal allotment of $2,500 we were allowed additional allotments of $600 and $252, making a total of $3,352. The regulations governing the Federal allotment make it necessary that the fund be expended in the payment of observers, and the Federal department have therefore carried a pay roll during the entire year of from 9 to 12 observers. Early in the spring, Mr. Louis S. Murphy, acting chief of State co-operation of the forest service, made an inspection trip to several towers throughout the western part of the State. His report was very satisfactory and we anticipate that we will receive our usual appropriation from the department again this coming year.

Respectfully submitted,

M. C. HUTCHINS,
State Fire Warden.

FOREST FIRES OF 1918.

MONTHS.	Number.	Acres.	Cost to extinguish.	Damage.
1917.				
December,	5	2	$11	$12
1918.				
January,	1	1	2	-
February,	6	11	21	-
March,	368	3,082	2,158	9,782
April,	1,215	21,850	12,508	113,332
May,	614	10,952	10,458	77,669
June,	91	486	734	752
July,	50	299	1,019	2,699
August,	47	429	551	589
September,	15	10	37	-
October,	66	223	279	320
November,	75	293	265	472
Totals,	2,553	37,638	$28,043	$205,627

TYPES OF LAND BURNED OVER (ACRES).

	1914.	1915.	1916.	1917.	1918.
Timber,	3,001	3,817	1,435	1,237	2,520
Second growth,	9,016	6,749	755	2,274	5,696
Second growth, not merchantable,	7,943	9,107	1,970	4,137	6,069
Brush land,	11,645	14,681	9,990	7,126	10,549
Grass land,	2,510	8,128	1,573	3,814	4,669
Not classified,	4,860	5,907	475	1,432	8,135
Totals,	38,975	48,389	16,198	20,020	37,638

CLASSIFIED CAUSES OF FOREST FIRES, 1913–18.

	1913.		1914.		1915.		1916.		1917.		1918.	
	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.
Unknown,	650	24.2	1,174	37.0	1,134	37.7	301	30.8	634	29.2	926	36.2
Railroad,	913	34.0	830	26.0	777	25.8	412	42.1	800	36.8	799	31.2
Burning brush,	148	5.5	196	6.2	439	14.5	79	8.1	262	12.0	300	11.7
Hunters (smokers),	386	14.3	520	16.4	129	4.2	111	11.3	224	10.3	237	9.2
Steam sawmills,	6	.2	3	.1	5	.1	2	.2	5	.2	14	.6
Children,	109	4.1	140	4.4	161	5.3	35	3.6	133	6.1	166	6.4
Miscellaneous,	476	17.7	318	9.9	363	12.4	38	3.9	117	5.4	111	4.7
Totals,	2,688	100.0	3,181	100.0	3,008	100.0	978	100.0	2,175	100.0	2,553	100.0

COMPARATIVE DAMAGES BY FOREST FIRES FOR THE PAST NINE YEARS.

YEAR.	Number of Fires.	Acreage burned.	Cost to extinguish.	Damage.	Average Acreage per Fire.	Average Damage per Fire.
1910,	1,385	42,221	$23,475	$205,383	30.46	$148 29
1911,	2,356	99,693	47,093	537,749	39.31	226 24
1912,	1,851	22,072	20,219	80,834	11.92	43 67
1913,	2,688	53,826	35,456	178,357	20.02	66 35
1914,	3,181	38,975	48,750	95,389	12.25	29 98
1915,	3,008	48,389	36,783	141,073	16.08	46 90
1916,	1,425	16,198	8,593	44,765	13.22	36 54
1917,	2,175	20,020	18,033	41,109	9.21	18 90
1918,	2,553	37,638	28,043	205,627	14.74	80 05

TYPES OF CLASSIFIED DAMAGES.

	1914.	1915.	1916.	1917.	1918.
Standing trees,	$50,697	$73,782	$18,786	$24,705	$71,706
Logs, lumber, cordwood,	4,427	23,544	4,545	4,680	37,815
Buildings,	3,530	31,904	10,823	6,893	46,025
Bridges, fences,	331	1,936	1,638	687	1,742
Not classified,	26,404	9,907	8,973	4,144	48,339
Totals,	$95,389	$141,073	$44,765	$41,109	$205,627

TOWNS RECEIVING FIRE-EQUIPMENT REIMBURSEMENT DURING 1918.

Bolton,	$9 00	Richmond,	$23 00
Groveland,	37 50	Sherborn,	4 35
Hampden,	9 17	Southwick,	9 50
Holbrook,	7 50	Sutton,	46 25
Littleton,	102 25		
Otis,	6 50	Total,	$276 27
Plainville,	21 25		

LECTURES AND ADDRESSES.

The following is a list of lectures and addresses delivered by the State Forester and his assistants during the year 1918: —

Cape Cod Cranberry Growers' Association.
Barnstable County Farm Bureau.
Massachusetts State Board of Agriculture.

National Wood Preservers' Association, Chicago, Ill.
New England Nurserymen's Association.
Borough Pomona Grange.
Mansfield Grange and Fuel Committee.
Massachusetts Fruit Growers' Association.
Rural Progress Meeting.
Boston Market Gardeners' Association.
New Braintree Farmers' Club.
Hyannis Board of Trade.
North Falmouth Grange.
Lynn Teachers' Club.
Newton Board of Trade.
Pomona Grange of Hardwick.
Milton Grange.
Pomona Grange, Cochituate.
Federal Horticultural Board, Washington, D. C.
Sherborn Grange.
Massachusetts Tree Wardens' and Foresters' Association.
Acushnet Grange.
Association of Massachusetts Agricultural Educators.
Society for the Protection of New Hampshire Forests.
New Hampshire Forestry Association.
Massachusetts Association of County Commissioners.
Blister Rust Conference.
Cape Cod Gypsy Moth Convention.
Allen School.
Dedham Grange.
Cambridge Public Schools.
Pomona Grange, Westwood.
Bethany Boys' Club, Roslindale.
New Bedford Farmers' Club.
Lynn Teachers' Association.
Field Meeting, State Grange, Monterey.
Westport Farmer's Institute.

STATE HIGHWAY WORK.

Along the State highways all over the State spraying for the gypsy moth and the elm-leaf beetle was done under the superintendence of this department. During the spring gypsy-moth infestations were also cleaned wherever such work could be done to good advantage. The total cost of this work for the year was $9,384.60.

THE DISTRIBUTION OF SUPPLIES.

The following is a list of cities and towns, with amount of supplies for moth work furnished them, for the year ending Nov. 30, 1918. The amounts given are the gross amounts furnished, some of the cities and towns having made payments to the State Forester's office for all or a part of the amounts according to their net expenditures or their class under the provisions of the law. For amounts received from this office in reimbursement and supplies see the table on page 36.

LIST OF CITIES AND TOWNS AND AMOUNTS OF SUPPLIES FURNISHED FOR 1918.

Acton,	$893 02	Georgetown,	$923 62
Andover,	10 80	Groton,	990 22
Ashburnham,	940 93[1]	Groveland,	290 79
Ashby,	1,020 32[1]	Halifax,	461 04
Ashland,	700 81	Hamilton,	852 53
Auburn,	1 45	Hanover,	1,022 34
Avon,	134 13	Hanson,	823 10
Ayer,	629 63	Harvard,	1,651 93
Bedford,	916 15	Harwich,	519 12
Berkley,	300 00	Holbrook,	552 29
Berlin,	559 19	Holden,	319 26
Billerica,	125 15	Hopkinton,	3 33
Bolton,	823 32	Hudson,	83 31
Bourne,	1,479 04[1]	Ipswich,	467 75
Boxborough,	1,096 40	Kingston,	513 12
Boxford,	874 13	Lakeville,	761 83
Boylston,	770 73[1]	Lexington,	42 56
Bridgewater,	1,514 90[1]	Lincoln,	2,905 69
Burlington,	886 64	Littleton,	1,188 97
Canton,	2,933 78	Lowell,	3 60
Carlisle,	967 33	Lunenburg,	1,302 60
Carver,	2,969 63	Lynnfield,	1,222 87
Chelmsford,	580 46	Manchester,	14 69
Danvers,	40 63	Marion,	3,854 89[1]
Dennis,	851 58[1]	Marlborough,	90 80
Dover,	672 38	Marshfield,	1,843 50
Dracut,	1,332 51	Mashpee,	579 96
Dunstable,	581 20	Medfield,	935 53
Duxbury,	3,027 08[1]	Merrimac,	504 26
Easton,	1,142 01	Methuen,	1,303 75
Essex,	342 65	Middleborough,	1,757 67
Foxborough,	788 34	Middleton,	481 33
Freetown,	668 00[1]	Newbury,	1,310 63

---

[1] This includes cost of sprayer.

List of Cities and Towns and Amounts of Supplies furnished for 1918 — *Concluded.*

Norfolk,	$242 36	Stoneham,	$923 27
North Andover,	48 89	Stoughton,	162 18
North Attleborough,	199 80	Stow,	1,664 15
North Reading,	1,184 29	Sudbury,	1,025 20
Northborough,	631 30	Templeton,	345 65
Norton,	521 54	Tewksbury,	1,098 86
Norwell,	1,583 91	Topsfield,	567 26
Pembroke,	2,351 66	Townsend,	904 58
Pepperell,	1,285 75	Truro,	146 40
Plainville,	59 75	Tyngsborough,	1,471 65
Plympton,	523 51	Waltham,	29 26
Princeton,	297 50	Wayland,	1,243 62
Quincy,	1 25	Wellfleet,	244 62
Raynham,	470 65	Wenham,	547 78
Reading,	7 02	West Boylston,	411 48
Rehoboth,	236 14	West Bridgewater,	777 03
Rochester,	215 32	West Newbury,	489 39
Rockport,	3 50	Westborough,	611 86
Rowley,	1,094 96	Westford,	2,386 58
Salisbury,	678 36	Westminster,	701 12
Sandwich,	3,717 21[1]	Weston,	3,395 55
Scituate,	1,424 52	Wilmington,	1,798 68
Sharon,	2 31	Winchendon,	984 88
Sherborn,	779 01	Worcester,	6 31
Shirley,	933 67	Wrentham,	397 25
Shrewsbury,	387 40	Yarmouth,	803 06
Southborough,	546 12		
Sterling,	188 22		$102,906 78

---

[1] This includes cost of sprayer.

State Forest Commission,	$6 75
Forestry and nurseries,	22 60
Prevention of forest fires,	49 03
Special North Shore work,	128 47
Purchase and planting of forest lands,	35 24
Thinning work,	146 51
Traveling sprayer,	130 90
	$519 50

FINANCIAL STATEMENTS.

GENERAL FORESTRY AND NURSERIES.

Receipts.

Appropriation for 1918,	$20,850 00	
Paul D. Kneeland, agent for Hubbard estate,	16 22	
		$20,866 22

Expenditures.

General: —		
Pay roll,	$7,121 29	
Travel,	2,742 65	
Printing,	319 12	
Maps, books, etc.,	14 06	
Supplies and equipment,	168 80	
Stationery and postage,	11 46	
Express, truck repairs, etc.,	491 49	
Nursery: —		
Pay roll,	$7,905 90	
Travel,	44 30	
Seed,	896 78	
Supplies and equipment,	654 25	
Express, freight and teaming,	383 84	
Sundries, telephone, etc.,	106 64	
		20,860 58
Balance returned to treasury Nov. 30, 1918,		$5 64

PURCHASE AND PLANTING OF FOREST LANDS.

Receipts.

Appropriation for 1918,		$10,000 00

Expenditures.

Pay roll,	$9,289 53	
Travel,	384 45	
Supplies and equipment,	156 80	
Express, freight and teaming,	155 10	
Sundries,	12 39	
		9,998 27
Balance returned to treasury Nov. 30, 1918,		$1 73

PREVENTION OF FOREST FIRES.

Receipts.

Appropriation for 1918,		$32,000 00

Expenditures.

Salaries,	$19,063 42	
Travel,	4,362 21	
Printing,	441 59	
Construction,	3,835 35	
Stationery and postage,	51 41	
Sundries and supplies,	170 35	
Equipment,	209 65	
Teams, freight and express,	94 89	
Telephone,	898 85	
Town supplies,	1,820 85	
Truck expenses,	309 94	
Rent and purchase of land,	739 40	
		31,997 91
Balance returned to treasury Nov. 30, 1918,		$2 09

OFFICE SALARIES.

Receipts.

Appropriation for 1918,	$6,900 00

Expenditures.

Salaries,	6,725 15
Balance returned to treasury Nov. 30, 1918,	$174 85

OFFICE INCIDENTALS.

Receipts.

Appropriation for 1918,		$5,000 00
Mileage sold,		3 70
		$5,003 70

Expenditures.

Travel,	$1,614 31	
Printing,	1,160 19	
Postage,	1,296 79	
Stationery and supplies,	342 56	
Maps, photographs, etc.,	174 28	
Educational work,	10 89	
Sundries (including telephone),	364 69	
		4,963 71
Balance returned to treasury Nov. 30, 1918,		$39 99

SUPPRESSION OF GYPSY AND BROWN-TAIL MOTHS.

Receipts.

Balance on hand Nov. 30, 1917,		$61,166 27	
Less reimbursements paid for 1917,		16,049 83	
Balance for 1918 work,		$45,116 44	
Receipts credited to appropriation: —			
State Forest Commission,	$148 37		
Investigation of blister rust,	93 37		
Forest fire prevention,	489 79		
General forestry and nurseries,	120 30		
Massachusetts Highway Commission,	90 02		
Topsfield (check returned),	2 00		
Balance Nov. 30, 1917, on special North Shore fund,	1,439 96		
Balance Nov. 30, 1917, on Sagamore Beach fund,	573 58		
Appropriation for 1918,	247,000 00		
		249,957 39	
			$295,073 83

Expenditures.

Pay roll,	$20,403 83	
Travel,	11,451 04	
Supplies,	107,058 38	
Rent of store,	300 00	
Store equipment,	121 74	
Special work,	24,314 94	
Town pay rolls,	30,493 24	
Reimbursements,	12,380 01	
Thinning work,	3,092 67	
Printing,	187 91	
Teaming, repairs, etc.,	1,479 95	
Stationery, postage,	40 66	
		211,324 37
Balance Nov. 30, 1918,		$83,749 46

STATEMENT OF RECEIPTS FOR 1918.

GENERAL FORESTRY AND NURSERIES.

For trees sold (white pine, 404,125; Scotch pine, 137,635; miscellaneous, 32,950),	$3,893 62
For wood sold, Otter River State Forest,	50 00
	$3,943 62

PURCHASE AND PLANTING OF FOREST LANDS.

Redemption of lots: —	
Charles K. Bolton,	$347 20
F. E. Watermeyer,	177 25
W. F. Whitney,	856 62
W. F. Whitney,	96 00
Cordwood sold: —	
Kelley-Field lot,	65 00
Fenno lot,	77 70
Hanson lot,	15 00
Damage by fire: —	
Boston & Maine Railroad,	40 00
Boston & Maine Railroad,	15 20
	$1,689 97

PREVENTION OF FOREST FIRES.

For equipment from towns and cities,	$1,327 94
For fire towers: —	
Acushnet,	300 00
Arlington,	100 00
Billerica,	200 00
Chelmsford,	300 00
Dracut,	150 00
Dunstable,	150 00
Fairhaven,	200 00
Freetown,	100 00
Littleton,	150 00
Mattapoisett,	200 00
Oak Bluffs,	200 00
Rochester,	100 00
Tewksbury,	150 00
Tyngsborough,	150 00
Westford,	250 00
New England Telephone & Telegraph Company,	86
Total,	$4,208 80

SUPPRESSION OF GYPSY AND BROWN-TAIL MOTHS.

Town of Andover,	$33 67
Town of Auburn,	84 90
Town of Ayer,	998 17
Town of Berkley,	132 48
Town of Bolton,	2 96
Town of Boylston,	392 72
Town of Bridgewater,	24 76
Town of Danvers,	115 38
Town of Dover,	666 00
Town of Duxbury,	64 21
Town of East Bridgewater,	1 50
Town of Essex,	924 28
Town of Franklin,	160 00
Town of Gloucester,	32 56
Town of Groton,	540 23
Town of Groveland,	212 01
Town of Hamilton,	296 95
Town of Holden,	1,131 32
Town of Holliston,	1 50
Town of Hopkinton,	828 71
Town of Ipswich,	356 76
Town of Lexington,	584 84
Town of Lincoln,	104 72
Town of Littleton,	427 74
City of Lowell,	30 32
Town of Lynnfield,	1,305 72
Town of Manchester,	43 26
City of Methuen,	776 74
Town of Natick,	181 84
City of Newton,	56 63
Town of North Andover,	167 92
Town of North Attleborough,	122 25
Town of Princeton,	1,039 94
Town of Raynham,	33 58
Town of Reading,	903 82
Town of Rehoboth,	296 66
Town of Rochester,	216 93
Town of Rowley,	5 40
Town of Saugus,	458 59
Town of Sharon,	400 00
Town of Sherborn,	147 99
Town of Shrewsbury,	1,571 08
Town of Somerset,	260 50
Amount carried forward,	$16,137 54

Amount brought forward,	$16,137 54
Town of Stoneham,	130 71
Town of Templeton,	1,179 81
Town of Topsfield,	2,071 56
Town of Upton,	3 13
Town of Wakefield,	7 42
Town of Walpole,	94 80
City of Waltham,	179 06
Town of West Boylston,	826 15
Town of Westminster,	591 01
Town of Weston,	2,274 14
Town of Winchendon,	2,323 13
Town of Wrentham,	1,091 83
City of Worcester,	6 31
Paul D. Kneeland, agent,	98 50
Boston & Maine Railroad,	18 84
Recreation Commissioners, Rhode Island,	2 40
American Railway Express,	7 00
	$27,043 34

FINANCIAL SUMMARY OF MOTH WORK BY TOWNS.

In the following table we show the expenditures in detail for the year 1918, and also the required expenditure for 1919.

CITIES AND TOWNS.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Abington,	$1,472 36	-	-	-	-	-	$1,499 08
Acton,	827 15	$892 23	$832 33[1] 57 30	$65 08	$893 02	$945 20	829 31
Acushnet,	609 16	-	-	-	-	-	650 66
Amesbury,	2,840 50	-	-	-	-	-	2,936 03
Andover,	3,126 90	3,749 58	1,700 15	498 14	10 80	498 14	3,207 08
Arlington,	5,000 00	-	-	-	-	-	5,000 00
Ashburnham,	528 33	895 38	115 00[1] 125 00	192 05	940 93	957 98	542 05
Ashby,	272 16	362 36	372 00[1]	-	1,020 32	845 32	280 42
Ashland,	637 91	-[2]	-[2]	-[2]	700 81	-[2]	651 08
Athol,	2,833 00	-	-	-	-	-	2,992 78
Attleboro,	5,000 00	-	-	-	-	-	5,000 00
Auburn,	802 25	258 49	87 00	-	1 45	-	853 20

[1] Arsenate of lead sold.

[2] Final papers not yet filed.

CITIES AND TOWNS.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Avon, . . .	$480 95	$448 75	$36 50	-	$134 13	$101 93	$489 03
Ayer, . . .	984 06	692 45	11 00[1] 195 25	-	629 63	544 27	1,228 07
Barnstable, . .	3,239 86	-	-	-	-	-	3,407 73
Barre, . . .	1,167 38	-	-	-	-	-	1,184 64
Bedford, . .	773 75	1,439 29	152 95[1] 1,335 17	$665 54	916 15	1,581 69	783 09
Bellingham, . .	461 15	-	-	-	-	-	502 83
Belmont, . .	4,718 18	-	-	-	-	-	5,000 00
Berkley, . .	245 02	219 13	59 49	-	300 00	274 11	245 14
Berlin, . . .	256 88	535 76	82 46	278 88	559 19	838 07	262 74
Beverly, . .	5,000 00	-	-	-	-	-	5,000 00
Billerica, . .	2,429 99	2,191 95	508 90[1] 128 81	-	125 15	-	2,515 84
Blackstone, . .	595 51	-	-	-	-	-	808 06
Bolton, . . .	312 86	775 15	682 75	462 29	823 32	1,285 61	322 51
Boston, . . .	5,000 00	-	-	-	-	-	5,000 00
Bourne, . . .	2,305 92	2,169 31	1,349 32	-	1,479 04	1,167 43	2,382 23
Boxborough, . .	124 72	173 71	723 30[1] 7 44	48 99	1,096 40	1,145 39	127 43
Boxford, . .	370 73	759 22	341 45	388 49	874 13	1,262 62	353 60
Boylston, . .	232 98	1,469 49	263 22	1,236 51	770 73	2,007 24	244 16
Braintree, . .	3,707 81	-	-	-	-	-	3,844 14
Brewster, . .	397 57	-	-	-	-	-	325 03
Bridgewater, . .	1,796 44	2,134 25	6 10[2] 1,052 88	162 81	1,514 90	1,502 71	1,805 40
Brimfield, . .	268 87	-	-	-	-	-	291 68
Brockton, . .	5,000 00	-	-	-	-	-	5,000 00
Brookfield, . .	599 01	-	-	-	-	-	636 39
Brookline, . .	5,000 00	-	-	-	-	-	5,000 00
Burlington, . .	420 44	1,087 08	302 99	666 64	886 64	1,553 28	445 66
Cambridge, . .	5,000 00	-	-	-	-	-	5,000 00
Canton, . . .	2,057 99	2,232 79	4,064 77	-	2,933 78	2,933 78	2,178 96
Carlisle, . .	210 13	2,143 09	601 09	1,932 96	967 33	2,900 29	201 35
Carver, . . .	828 47	3,640 51	247 50[1] 1,180 00	2,812 04	2,969 63	5,781 67	796 43
Charlton, . .	580 48	-	-	-	-	-	608 27
Chatham, . .	893 48	-	-	-	-	-	947 40
Chelmsford, . .	1,915 91	1,848 21	1,504 26	-	580 46	512 76	2,004 25
Chelsea, . .	5,000 00	-	-	-	-	-	5,000 00
Chilmark, . .	164 33	-	-	-	-	-	172 32
Clinton, . .	3,890 97	-	-	-	-	-	3,959 97

[1] Arsenate of lead sold.

[2] Supplies sold.

CITIES AND TOWNS.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Cohasset, . .	$2,486 12	-	-	-	-	-	$2,461 57
Concord, . .	2,761 80	-	-	-	-	-	2,804 60
Dana, . . .	182 48	-	-	-	-	-	194 23
Danvers, . .	3,180 27	-	-	-	$40 63	-	3,276 13
Dartmouth, . .	2,259 78	-	-	-	-	-	2,361 12
Dedham, . .	5,000 00	-	-	-	-	-	5,000 00
Deerfield, . .	1,360 46	-	-	-	-	-	1,479 12
Dennis, . . .	509 13	$850 27	-	$153 64	851 58	$1,005 22	543 96
Dighton, . .	860 61	-	-	-	-	-	958 06
Douglas, . .	568 38	-	-	-	-	-	577 20
Dover, . . .	1,000 71	876 75	$744 81	-	672 38	-	1,067 24
Dracut, . . .	1,095 00	2,017 56	682 24	922 56	1,332 51	2,255 07	1,138 53
Dudley, . .	969 54	-	-	-	-	-	997 13
Dunstable, . .	144 52	573 71	437 05	429 19	581 20	1,010 39	161 23
Duxbury, . .	1,268 17	2,612 75	1,438 66	782 08	3,027 08	3,246 66	1,355 11
East Bridgewater, .	1,307 24	-	-	-	-	-	1,344 96
Eastham, . .	175 82	-	-	-	-	-	177 50
Easthampton, .	3,925 74	-	-	-	-	-	4,242 00
Easton, . . .	1,618 75	1,966 66	1,241 55	347 91	1,142 01	1,489 92	1,608 91
Edgartown, . .	635 11	-	-	-	-	-	684 33
Essex, . . .	518 83	645 13	546 75	126 30	342 65	468 95	524 84
Everett, . .	5,000 00	-	-	-	-	-	5,000 00
Fairhaven, . .	2,250 83	-	-	-	-	-	2,457 19
Fall River, . .	5,000 00	-	-	-	-	-	5,000 00
Falmouth, . .	2,774 32	-	-	-	-	-	2,846 73
Fitchburg, . .	5,000 00	-	-	-	-	-	5,000 00
Foxborough, . .	1,146 04	1,754 01	253 41	607 97	788 34	1,396 31	1,191 49
Framingham, .	5,000 00	-	-	-	-	-	5,000 00
Franklin, . .	2,155 79	-	-	-	-	-	2,234 46
Freetown, . .	474 24	648 07	-	-	668 00	493 00	517 56
Gardner, . .	4,296 30	-	-	-	-	-	4,556 03
Georgetown, . .	533 93	939 59	527 57	405 66	923 62	1,329 28	534 40
Gloucester, . .	5,000 00	-	-	-	-	-	5,000 00
Grafton, . .	1,334 07	677 46	195 00	-	-	-	1,396 48
Great Barrington, .	3,469 34	-	-	-	-	-	3,603 13
Greenfield, . .	5,000 00	-	-	-	-	-	5,000 00

Cities and Towns.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Groton, . . .	$1,124 62	$1,399 69	$495 32[1] 278 93	$275 07	$990 22	$1,265 29	$1,138 98
Groveland, . .	577 09	504 09	117 45 452 15	-	290 79	217 79	597 77
Halifax, . . .	295 75	998 87	241 17	703 12	461 04	1,164 16	311 94
Hamilton, . .	1,471 49	2,116 78	1,229 24	645 29	852 53	1,497 82	1,561 12
Hanover, . .	725 05	1,255 74	1,258 80	591 41	1,022 34	1,613 75	777 13
Hanson, . .	808 13	662 35	669 44	-	823 10	677 32	824 01
Harvard, . .	758 79	1,570 06	1,651 23	811 27	1,651 93	2,463 20	771 45
Harwich, . .	759 81	1,318 45	64 15	558 64	519 12	1,077 76	779 48
Haverhill, . .	5,000 00	-	-	-	-	-	5,000 00
Hingham, . .	2,740 55	-	-	-	-	-	2,811 67
Holbrook, . .	696 49	661 76	211 36	-	552 29	517 56	739 00
Holden, . . .	752 17	1,545 96	373 51	793 79	319 26	1,113 05	828 56
Holliston, . .	806 59	-	-	-	-	-	840 67
Hopedale, . .	1,923 46	-	-	-	-	-	1,709 00
Hopkinton, . .	751 34	651 88	77 00	-	3 33	-	751 74
Hubbardston, .	326 63	-	-	-	-	-	326 19
Hudson, . .	1,750 70	1,271 54	9 55[1] 659 77	-	83 31	-	1,882 75
Hull, . . .	4,112 01	-	-	-	-	-	4,284 04
Ipswich, . .	2,211 59	2,593 71	1,978 73	382 12	467 75	849 87	2,254 91
Kingston, . .	638 84	948 61	345 96	309 77	513 12	822 89	658 63
Lakeville, . .	478 23	626 24	387 93	148 01	761 83	909 84	490 01
Lancaster, . .	957 23	-	-	-	-	-	963 67
Lawrence, . .	5,000 00	-	-	-	-	-	5,000 00
Leicester, . .	950 44	-	-	-	-	-	1,072 55
Lenox, . . .	2,918 70	-	-	-	-	-	2,961 12
Leominster, . .	5,000 00	-	-	-	-	-	5,000 00
Lexington, . .	3,396 08	5,863 80	23 60[1] 1,681 39	1,965 67	42 56	1,999 72	3,410 94
Leyden, . . .	99 09	-	-	-	-	-	108 19
Lincoln, . .	755 21	1,491 68	1,816 78	736 47	2,905 69	3,642 16	751 37
Littleton, . .	516 45	-	749 70[1] 68 25	-	1,188 97	660 36	536 99
Lowell, . . .	5,000 00	-	-	-	3 60	-	5,000 00
Lunenburg, . .	668 27	1,048 40	350 33 1,786 44	380 13	1,302 60	1,682 73	683 59
Lynn, . . .	5,000 00	-	-	-	-	-	5,000 00
Lynnfield, . .	603 05	1,768 42	683 64	1,165 35	1,222 87	2,388 22	646 99
Malden, . . .	5,000 00	-	-	-	-	-	5,000 00
Manchester, . .	4,441 58	-	-	-	14 69	-	4,468 66

Cities and Towns.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Mansfield, . .	$1,886 67	-	-	-	-	-	$2,128 25
Marblehead, . .	4,439 43	-	-	-	-	-	4,642 13
Marion, . . .	1,289 42	$2,266 76	$1,135 03	589 84	$3,354 89	$3,944 73	1,305 77
Marlborough, .	4,457 76	-	-	-	90 80	-	4,683 77
Marshfield, . .	1,038 17	1,550 31	125 00[1] 1,259 71	512 14	1,843 50	2,355 64	1,097 80
Mashpee, . .	185 57	2,062 19	833 94	1,876 62	579 96	2,456 58	186 18
Mattapoisett, .	733 01	-	-	-	-	-	744 37
Maynard, . .	1,874 24	-	-	-	-	-	1,819 15
Medfield, . .	857 89	531 56	28 00[1] 356 10	-	935 53	609 20	858 25
Medford, . .	5,000 00	-	-	-	-	-	5,000 00
Medway, . .	766 34	-	-	-	-	-	770 78
Melrose, . . .	5,000 00	-	-	-	-	-	5,000 00
Mendon, . .	298 02	-	-	-	-	-	304 37
Merrimac, . .	636 86	1,194 26	288 25	557 40	504 26	1,061 66	651 71
Methuen, . .	4,238 23	–[2]	–[2]	–[2]	1,303 75	–[2]	5,000 00
Middleborough, .	1,961 52	3,607 78	1,581 61	1,646 26	1,757 67	3,403 93	2,013 95
Middleton, . .	396 36	1,287 63	534 00	891 27	481 33	1,372 60	401 84
Milford, . . .	4,100 52	-	-	-	-	-	4,194 49
Millbury, . .	1,363 30	-	-	-	-	-	1,404 94
Millis, . . .	592 77	-	-	-	-	-	640 73
Millville, . .	483 05	-	-	-	-	-	501 66
Milton, . . .	5,000 00	7,868 98	6,438 66	1,434 49	-	1,434 49	5,000 00
Monson, . .	732 97	-	-	-	-	-	868 76
Montague, . .	3,199 20	-	-	-	-	-	3,423 75
Nahant, . .	1,663 35	-	-	-	-	-	1,653 67
Nantucket, . .	2,145 30	-	-	-	-	-	2,202 52
Natick, . . .	3,143 58	6,044 88	113 75	-	-	-	3,402 99
Needham, . .	3,663 50	-	-	-	-	-	3,851 44
New Bedford, .	5,000 00	-	-	-	-	-	5,000 00
New Braintree, .	174 07	-	-	-	-	-	188 95
New Salem, . .	197 89	-	-	-	-	-	222 07
Newbury, . .	595 89	1,135 76	613 40[1] 574 11	539 87	1,310 63	1,850 50	603 38
Newburyport, .	4,531 57	-	-	-	-	-	4,582 32
Newton, . .	5,000 00	-	-	-	-	-	5,000 00
Norfolk, . .	472 55	516 88	181 20	44 13	242 36	286 49	482 04
North Andover, .	2,159 71	2,407 21	153 00[1] 886 63	247 50	48 89	296 39	2,364 66

[1] Arsenate of lead sold.

[2] Final papers not yet filed.

Cities and Towns.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
No. Attleborough, . .	$3,371 41	-	-	-	$199 80	-	$3,332 90
North Brookfield, .	786 56	-	-	-	-	-	832 08
North Reading, .	439 46	$1,817 97	$632 17	$1,378 51	1,184 29	$2,562 80	453 16
Northborough, .	777 62	811 89	193 57	34 27	631 80	665 57	773 89
Northbridge, . .	2,052 11	-	-	-	-	-	2,134 13
Norton, . . .	701 16	1,049 61	163 33	348 45	521 54	869 99	721 70
Norwell, . .	505 42	1,067 06	1,134 94	561 64	1,583 91	2,145 55	505 65
Norwood, . .	5,000 00	-	-	-	-	-	5,000 00
Oak Bluffs, . .	865 02	-	-	-	-	-	905 45
Oakham, . .	157 15	-	-	-	-	-	181 85
Orange, . . .	1,586 90	-	-	-	-	-	1,652 96
Orleans, . . .	560 42	-	-	-	-	-	529 73
Oxford, . . .	855 22	-	-	-	-	-	856 69
Palmer, . . .	2,356 77	-	-	-	-	-	2,756 51
Paxton, . .	170 68	-	-	-	-	-	170 91
Peabody, . .	5,000 00	-	-	-	-	-	5,000 00
Pembroke, . .	513 71	2,411 15	1,038 72	1,897 44	2,351 66	4,249 10	541 89
Pepperell, . .	973 83	1,758 25	625 34	784 92	1,285 75	2,070 67	1,017 64
Petersham, . .	409 08	-	-	-	-	-	428 76
Phillipston, . .	131 28	-	-	-	-	-	135 88
Plainville, . .	438 51	510 73	111 60	72 22	59 75	131 97	446 83
Plymouth, . .	5,000 00	-	-	-	-	-	5,000 00
Plympton, . .	198 07	1,264 70	{ 12 00[1] 97 30 }	1,066 63	523 51	1,590 14	196 55
Princeton, . .	438 93	2,746 38	116 69	2,307 45	297 50	2,604 95	447 82
Provincetown, .	1,065 05	-	-	-	-	-	1,264 48
Quincy, . . .	5,000 00	-	-	-	1 25	-	5,000 00
Randolph, . .	1,120 90	-	-	-	-	-	1,121 36
Raynham, . .	409 97	750 43	207 26	340 46	470 65	811 11	506 25
Reading, . .	3,087 12	-	-	-	7 02	-	3,233 19
Rehoboth, . .	446 94	-	-	-	236 14	-	471 23
Revere, . . .	5,000 00	-	-	-	-	-	5,000 00
Rochester, . .	425 89	551 40	136 31	125 51	215 32	340 83	436 95
Rockland, . .	2,091 69	-	-	-	-	-	2,168 15
Rockport, . .	1,674 62	-	-	-	3 50	-	1,732 93
Rowley, . .	388 92	1,041 36	{ 360 80[1] 416 97 }	652 44	1,094 95	1,747 39	405 24
Royalston, . .	321 46	-	-	-	-	-	357 73

[1] Arsenate of lead sold.

Cities and Towns.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Rutland, . .	$380 48	–	–	–	–	–	$400 93
Salem, . . .	5,000 00	–	–	–	–	–	5,000 00
Salisbury, . .	753 44	$1,224 70	$134 94[1] 382 18	$471 26	$678 36	$1,149 62	783 06
Sandwich, . .	538 70	1,083 65	155 68[1] 966 60	357 45	3,717 21	4,074 66	575 71
Saugus, . . .	2,979 20	–	–	–	–	–	3,127 06
Scituate, . .	2,290 97	–[2]	–[2]	–[2]	1,424 52	–[2]	2,473 49
Seekonk, . .	805 78	–	–	–	–	–	850 77
Sharon, . . .	1,360 82	–	–	–	2 31	–	1,409 18
Sherborn, . .	655 04	1,782 39	344 68[1] 839 18	1,127 35	779 01	1,906 36	643 83
Shirley, . . .	551 63	825 79	108 00[1] 170 80	274 16	933 67	1,207 83	574 76
Shrewsbury, . .	1,370 92	1,290 95	98 34[1] 591 40	–	387 40	307 43	1,453 30
Somerset, . .	775 25	–	–	–	–	–	811 68
Somerville, . .	5,000 00	–	–	–	–	–	5,000 00
Southborough, .	867 82	998 73	484 98	130 91	546 12	677 03	878 48
Spencer, . .	1,394 44	–	–	–	–	–	1,424 03
Springfield, . .	5,000 00	–	–	–	–	–	5,000 00
Sterling, . .	545 18	691 90	198 80[1] 127 98	146 72	188 22	334 94	556 27
Stockbridge, . .	1,783 43	–	–	–	–	–	1,804 38
Stoneham, . .	2,544 14	2,542 57	1,478 09	–	923 27	737 36	2,613 96
Stoughton, . .	1,953 36	1,363 93	37 80[1] 515 62	–	162 18	–	2,254 84
Stow, . . .	404 70	1,042 10	567 60[1] 308 14	637 40	1,664 15	2,301 55	456 71
Sturbridge, . .	377 30	–	–	–	–	–	399 88
Sudbury, . .	577 93	720 36	591 92[1] 545 09	142 43	1,025 20	1,167 63	574 06
Sutton, . . .	615 46	–	–	–	–	–	650 46
Swampscott, . .	5,000 00	–	–	–	–	–	5,000 00
Swansea, . .	717 36	–	–	–	–	–	731 06
Taunton, . .	5,000 00	–	–	–	–	–	5,000 00
Templeton, . .	838 65	821 74	261 00	–	345 65	328 74	1,021 79
Tewksbury, . .	1,080 63	1,816 97	664 30	736 34	1,098 86	1,835 20	1,112 63
Tisbury, . .	837 94	–	–	–	–	–	839 40
Topsfield, . .	835 27	–[2]	–[2]	–[2]	567 26	–[2]	877 39
Townsend, . .	557 20	1,377 80	598 35	830 60	904 58	1,725 18	563 69
Truro, . . .	213 19	220 19	7 00	7 00	146 40	153 40	222 85
Tyngsborough, .	344 27	2,530 22	1,808 11	2,246 77	1,471 65	3,718 42	369 37
Upton, . . .	500 91	–	–	–	–	–	565 98
Uxbridge, . .	1,622 92	–	–	–	–	–	1,743 96

[1] Arsenate of lead sold.

[2] Final papers not yet filed.

Cities and Towns.	1918.						1919.
	Required Expenditure.	Total Net Expenditure.	Private Work.	Reimbursement.	Tools supplied.	Total Amount received from State.	Required Expenditure.
Wakefield, . .	$5,000 00	-	-	-	-	-	$5,000 00
Walpole, . .	2,875 16	-	-	-	-	-	2,965 19
Waltham, . .	5,000 00	-	-	-	$29 26	-	5,000 00
Ware, . . .	2,102 10	-	-	-	-	-	2,467 70
Wareham, . .	2,424 35	-	-	-	-	-	2,520 54
Warren, . . .	1,055 77	-	-	-	-	-	1,073 46
Warwick, . .	181 58	-	-	-	-	-	181 87
Watertown, . .	5,000 00	-	-	-	-	-	5,000 00
Wayland, . .	948 84	$1,029 45	$697 32	$80 61	1,243 62	$1,324 23	968 88
Webster, . .	2,383 03	-	-	-	-	-	2,578 86
Wellesley, . .	5,000 00	-	-	-	-	-	5,000 00
Wellfleet, . .	322 69	713 04	34 95	390 35	244 62	634 97	323 57
Wendell, . .	228 18	-	-	-	-	-	236 90
Wenham, . .	843 92	592 84	453 61	-	547 78	296 70	890 26
West Boylston, .	436 90	427 43	432 41	-	411 48	406 99	442 91
West Bridgewater, .	755 60	1,955 61	615 81	1,200 01	777 03	1,977 04	757 85
West Newbury, .	406 41	328 46	179 30[1] 248 61	-	489 39	411 44	407 98
West Tisbury, .	232 34	-	-	-	-	-	226 09
Westborough, .	1,333 93	1,542 41	592 29	206 48	611 86	820 34	1,341 81
Westford, . .	929 94	506 57	508 00[1] 1,467 08	-	2,386 58	1,962 11	958 83
Westminster, . .	394 05	733 30	196 00	164 25	701 12	526 12	403 89
Weston, . . .	1,997 26	1,930 16	600 00	-	3,395 55	3,328 45	2,012 96
Westport, . .	1,102 16	-	-	-	-	-	1,234 39
Westwood, . .	990 30	-	-	-	-	-	1,061 71
Weymouth, . .	5,000 00	-	-	-	-	-	5,000 00
Whately, . .	319 17	-	-	-	-	-	324 15
Whitman, . .	2,270 11	-	-	-	-	-	2,282 27
Wilmington, . .	864 35	1,773 73	1,029 24	909 38	1,798 68	2,708 06	879 46
Winchendon, . .	1,791 56	3,250 03	608 13	1,283 47	984 88	2,093 35	1,813 99
Winchester, . .	5,000 00	-	-	-	-	-	5,000 00
Winthrop, . .	5,000 00	-	-	-	-	-	5,000 00
Woburn, . .	5,000 00	-	-	-	-	-	5,000 00
Worcester, . .	5,000 00	-	-	-	6 31	-	5,000 00
Wrentham, . .	680 35	-	-	-	397 25	-	699 86
Yarmouth, . .	731 25	1,151 08	119 25	232 33	803 06	1,035 41	760 41

---

[1] Arsenate of lead sold.

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS.

[Alphabetically by towns and cities.]

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
157-W, Rockland,	Sumner L. Deane,	**Abington,**	C. F. Shaw,	4
76-4,	Wm. H. Kingsley,	**Acton,**	J. O'Neil,	2
2003-M, New Bedford.	Henry F. Taber,	**Acushnet,**	A. P. R. Gilmore,	3
206-W, Kippers,	John Clancy,	**Adams,**	John Clancy,	5
6465-M, River,	E. M. Hitchcock,	**Agawam,**	E. M. Hitchcock,	5
161-6, Great Barrington.	W. F. Milligan,	**Alford,**	- -	-
274-M,	Jas. E. Feltham,	**Amesbury,**	A. L. Stover,	1
483-J,	A. F. Bardwell,	**Amherst,**	W. H. Smith,	5
- -	Lester Hilton,	**Andover,**	J. H. Playdon,	1
35 and 206,	Walter H. Pierce,	**Arlington,**	Daniel M. Daley,	1
- -	John T. Withington,	**Ashburnham,**	Chas. H. Pratt,	2
2-3,	W. S. Greene,	**Ashby,**	Fred C. Allen,	2
3-5,	Ralph Tredick,	**Ashfield,**	Chas. A. Smith,	5
506-W,	George Reall,	**Ashland,**	Theodore P. Hall,	2
18-3,	Frank P. Hall,	**Athol,**	W. S. Penniman,	5
34-R-4,	H. R. Packard,	**Attleboro,**	W. E. S. Smith,	3
5-12,	J. F. Searle,	**Auburn,**	B. F. Searle,	5
3259-M,	J. W. McCarty,	**Avon,**	W. W. Beals,	3
123-2,	D. C. Smith,	**Ayer,**	D. C. Smith,	2
144-2,	H. C. Bacon,	**Barnstable,**	Robert Cross,	4
83-4,	A. C. Traver,	**Barre,**	Jas. A. Dwinnell,	5
8000 and 18,	P. B. McCormick,	**Becket,**	- -	-
- -	Irving C. Waite,	**Bedford,**	W. A. Cutler,	2
- -	J. A. Peeso,	**Belchertown,**	E. C. Howard,	5
8639-2, Milford,	L. F. Thayer,	**Bellingham,**	Lewis E. Whitney,	3
409-W,	John F. Leonard,	**Belmont,**	Martin Troy,	2
1367-M,	Gideon H. Babbitt,	**Berkley,**	A. A. Briggs,	3
17-2,	Forrest E. Day,	**Berlin,**	E. C. Ross,	2
43-12,	Edson W. Hale,	**Bernardston,**	E. D. Hale,	5
20,	Robert H. Grant,	**Beverly,**	Jas. W. Blackmer,	1
22-2,	E. N. Bartlett,	**Billerica,**	Fred L. Winship,	2
9250,	John H. Dwyer,	**Blackstone,**	A. J. Duggan,	5
16-3,	I. E. Whitney,	**Blandford,**	- -	-
29-12,	J. M. Pardee,	**Bolton,**	C. E. Mace,	2
- -	- -	**Boston,**	Wm. P. Long,	1
38,	Walter E. R. Nye,	**Bourne,**	Edward D. Nickerson,	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
102-2, West Acton,	H. J. Livermore,	**Boxborough,**	S. D. Salmon, 3d,	2
19-25,	Clarence E. Brown,	**Boxford,**	C. Perley,	1
29-2,	John N. Flagg,	**Boylston,**	Walter G. Brigham,	5
433-R,	Jas. M. Cutting,	**Braintree,**	Clarence R. Bestick,	3
76-23,	T. B. Tubman,	**Brewster,**	Allison D. Rogers,	4
281-3,	F. C. Worthen,	**Bridgewater,**	F. C. Worthen,	4
18-2,	G. E. Hitchcock,	**Brimfield,**	C. W. King,	5
1041,	Wm. F. Daly,	**Brockton,**	Rufus H. Carr,	4
104-11,	P. D. Gadare,	**Brookfield,**	J. H. Conant,	5
– –	George H. Johnson,	**Brookline,**	Ernest B. Dane,	1
52-8,	Gilbert E. Griswold,	**Buckland,**	– –	–
15-4,	W. W. Skelton,	**Burlington,**	W. W. Skelton,	2
– –	– –	**Cambridge,**	J. F. Donnelly,	2
76 and 24-M,	Ralph C. Crowell,	**Canton,**	Wm. H. Gallivan,	3
76-M, Concord,	George G. Wilkins,	**Carlisle,**	George G. Wilkins,	2
16-2,	H. F. Atwood,	**Carver,**	H. F. Atwood,	4
14-12,	A. L. Vever,	**Charlemont,**	– –	–
42-2,	Edw. A. Lamb,	**Charlton,**	J. D. Fellows,	5
28-3,	George W. Ryder,	**Chatham,**	Chas. R. Nickerson,	4
1597-R, Lowell,	A. C. Perham,	**Chelmsford,**	Walter Shepard,	2
– –	– –	**Chelsea,**	J. A. O'Brien,	1
285-J,	S. W. Curtis,	**Cheshire,**	– –	–
1,	Wm. H. Babb,	**Chester,**	– –	–
4-2,	Chas. A. Bisbee,	**Chesterfield,**	– –	–
149-M and 149-W,	John E. Pomphret,	**Chicopee,**	Edw. Bourbeau,	5
– –	Robert W. Vincent,	**Chilmark,**	A. S. Tilton,	4
485-X,	A. G. Caswell,	**Clarksburg,**	A. G. Caswell,	5
268-W and 180,	A. W. Custance,	**Clinton,**	Peter R. Gibbons,	2
260,	Wm. J. Brennick,	**Cohasset,**	George Young,	4
23-2,	Frank A. Walden,	**Colrain,**	E. F. Copeland,	5
72 and 458-M,	Harry E. Tuttle,	**Concord,**	H. P. Richardson,	2
15-2,	Edgar Jones,	**Conway,**	– –	–
– –	Wm. H. Mansell,	**Cummington,**	– –	–
86-W,	S. L. Caesar,	**Dalton,**	– –	–
– –	T. L. Thayer,	**Dana,**	T. L. Thayer,	5
495-W,	Wm. H. Berry,	**Danvers.**	T. E. Tinsley,	1
1658-5, New Bedford.	Chas. H. Meade,	**Dartmouth,**	E. M. Munson,	3

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
373-35-R,	Henry J. Harrigan,	**Dedham,**	J. T. Kennedy,	3
- -	Wm. L. Harris,	**Deerfield,**	Wm. L. Harris,	5
8118-4,	C. E. Pierce,	**Dennis,**	Joshua Crowell,	4
29-3,	Ralph Earle,	**Dighton,**	Albert N. Goff,	3
11-4,	W. L. Church,	**Douglas,**	F. J. Libby,	5
63-11,	John Breagy,	**Dover,**	H. L. MacKenzie,	3
- -	Frank H. Gunther,	**Dracut,**	T. F. Carrick,	2
- -	Frank A. Putnam,	**Dudley,**	Herbert J. Hill,	5
- -	Arthur N. Hall,	**Dunstable,**	W. H. Savill,	2
82-2,	H. E. Merry,	**Duxbury,**	John D. Morrison,	4
24-2,	Lester W. Bourne,	**E. Bridgewater,**	Lester W. Bourne,	4
- -	Asher Markhan,	**E. Longmeadow,**	Herman W. King,	5
24-3,	Adin L. Gill,	**Eastham,**	N. P. Clark,	4
306-12,	John M. Gineen,	**Easthampton,**	Chas. Kuhfuss,	5
67 and 76,	Frederick Hanlon,	**Easton,**	John S. Ames,	3
- -	Maniel Roberts,	**Edgartown,**	John P. Fuller,	4
165-25,	Frank Bradford,	**Egremont,**	- -	-
17-11,	H. A. Coolbeth,	**Enfield,**	H. C. Moore,	5
- -	C. H. Holmes,	**Erving,**	C. H. Holmes,	5
51-3,	Otis O. Story,	**Essex,**	Otis O. Story,	1
- -	- -	**Everett,**	P. O. Sefton,	2
1686-Y,	C. F. Benson,	**Fairhaven,**	G. W. King,	3
822-W,	Wm. Stevenson,	**Fall River,**	Wm. Stevenson,	3
136-2,	H. H. Lawrence,	**Falmouth,**	W. W. Eldridge, Jr.,	4
745,	G. A. Hubbard,	**Fitchburg,**	G. A. Hubbard,	2
9417-3, Hoosac Tunnel pay station.	Horace B. Brown,	**Florida,**	- -	-
131 and 76,	Ernest A. White,	**Foxborough,**	C. W. Parkhurst,	3
352-4,	Burt P. Winch,	**Framingham,**	N. I. Bowditch,	2
66-12,	Edw. S. Cook,	**Franklin,**	J. W. Stobbart,	3
7-0,	Oscar N. Hanson,	**Freetown,**	G. M. Nichols,	3
161 and 191,	George S. Hodgman,	**Gardner,**	Chas. J. Crabtree,	5
209-25,	Napoleon B. Madison,	**Gay Head,**	Napoleon B. Madison,	4
71-12 and 8046-2,	Thos. A. Watson,	**Georgetown,**	Elwood T. Wildes,	1
232-12,	Lewis C. Munn,	**Gill,**	Chas. H. Whittaker,	5
1043-M,	George W. O'Maley,	**Gloucester,**	George W. O'Maley,	1
18-4,	John S. Mollison,	**Goshen,**	- -	-
- -	Harold S. Veeder,	**Gosnold,**	- -	-

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
18-2,	Elmer E. Sibley,	**Grafton,**	C. K. Despeau,	5
– –	George L. Murray,	**Granby,**	George A. Harris,	5
5-13,	Albert C. Sheets,	**Granville,**	– –	–
327-W,	D. W. Flynn,	**Gt. Barrington,**	T. J. Kearin,	5
1185,	J. W. Bragg,	**Greenfield,**	J. W. Bragg,	5
33-24, Enfield,	W. H. Walker,	**Greenwich,**	Thos. Severance, Jr.,	5
71-5,	C. M. Raddin,	**Groton,**	Shadrach Evans,	2
2939-M,	S. E. Johnson,	**Groveland,**	R. D. Larive,	1
651-33,	E. P. West,	**Hadley,**	Leroy C. Sabin,	5
106-7, Bridgewater.	D. M. Briggs,	**Halifax,**	John A. Wood,	4
62,	Fred Berry,	**Hamilton,**	E. G. Brewer,	1
5-14,	Edw. P. Lyons,	**Hampden,**	– –	–
17-F-2,	Chas. Tucker,	**Hancock,**	– –	–
51-5, Rockland,	Chas. E. Damon,	**Hanover,**	Chas. B. Drew,	4
12-23, Bryantville.	George T. Moore,	**Hanson,**	George T. Moore,	4
43-12,	George J. Fay,	**Hardwick,**	George J. Fay,	5
63-3,	G. C. Maynard,	**Harvard,**	G. C. Maynard,	2
103-3,	John Condon,	**Harwich,**	Arthur F. Cahoon,	4
72-4,	Fred T. Bardwell,	**Hatfield,**	Seth W. Kingsley,	5
– –	John B. Gordon,	**Haverhill,**	M. J. Fitzgerald,	1
17-7,	Herbert A. Holden,	**Hawley,**	– –	–
5-18,	S. G. Benson,	**Heath,**	– –	–
500,	George Cushing,	**Hingham,**	T. L. Murphy,	4
26-6,	L. L. Sherman,	**Hinsdale,**	– –	–
130-W and 297-M, Randolph.	Melvin L. Coulter,	**Holbrook,**	Walter C. Belcher,	3
42-4,	Winfred H. Stearns,	**Holden,**	Winfred H. Stearns,	5
5-21, Brimfield,	Oliver H. Howlett,	**Holland,**	W. A. Morse,	5
113,	W. A. Collins,	**Holliston,**	Herbert E. Jones,	2
1167-W,	C. J. Haley,	**Holyoke,**	T. A. Bray,	5
248-W,	S. E. Kellogg,	**Hopedale,**	C. E. Nutting,	5
19,	George W. Smith,	**Hopkinton,**	W. A. MacMillan,	5
24-5,	R. W. Hartwell,	**Hubbardston,**	R. W. Hartwell,	5
24,	M. P. Mitchell,	**Hudson,**	T. J. Higgins,	2
– –	– –	**Hull,**	J. Knowles,	4
4-11,	John J. Kirby,	**Huntington,**	– –	–
137-W,	Edw. H. Smith,	**Ipswich,**	J. A. Morey,	1
103,	Roland Bailey,	**Kingston,**	Chas. H. Childs,	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
261-W,	N. F. Washburn,	**Lakeville,**	N. F. Washburn,	4
218-J,	Arthur W. Blood,	**Lancaster,**	L. R. Griswold,	2
1295-24,	King D. Keeler,	**Lanesborough,**	King D. Keeler,	5
362 and 3610,	Francis J. Morris,	**Lawrence,**	John A. Flanagan,	1
66-M,	James W. Bossidy,	**Lee,**	– –	–
37-5,	B. H. Fogwell,	**Leicester,**	J. H. Woodhead,	5
– –	Oscar Hutchinson,	**Lenox,**	T. Francis Mackey,	5
28, 29 and 506,	F. A. Russell,	**Leominster,**	D. E. Bassett,	2
9-43,	Mellen H. Briggs,	**Leverett,**	I. H. Taylor,	5
480,	Osborne J. Gorman,	**Lexington,**	Osborne J. Gorman,	2
274-41,	Jacob Sauter,	**Leyden,**	Jacob Sauter,	5
44-W,	John J. Kelliher,	**Lincoln,**	John J. Kelliher,	2
17-4,	A. E. Hopkins,	**Littleton,**	A. E. Hopkins,	2
– –	Oscar C. Pomeroy,	**Longmeadow,**	– –	–
3400,	Edw. F. Saunders,	**Lowell,**	J. G. Gordon,	2
1-12,	H. A. Munson,	**Ludlow,**	Ashley N. Bucher,	5
20,	J. S. Gilchrest,	**Lunenburg,**	J. S. Gilchrest,	2
1174 and 5613-J,	D. J. Dineen,	**Lynn,**	Arthur W. Lewis,	1
9-3,	Lewis F. Pope,	**Lynnfield,**	L. H. Twiss,	1
– –	Watson B. Gould,	**Malden,**	Watson B. Gould,	2
319-W,	Peter Sheahan,	**Manchester,**	Peter A. Sheahan,	1
281-W and 1-W,	Herbert E. King,	**Mansfield,**	E. Jasper Fisher,	3
355,	John T. Adams,	**Marblehead,**	W. H. Stevens,	1
117-2,	George B. Nye,	**Marion,**	J. Allenach,	4
– –	Edw. C. Minahan,	**Marlborough,**	M. E. Lyons,	2
43-3,	W. G. Ford,	**Marshfield,**	P. R. Livermore,	4
31-2, Cotuit,	Darius Coombs,	**Mashpee,**	S. H. Peters,	4
53-5,	Chas. T. Dexter,	**Mattapoisett,**	F. A. Tinkham,	4
115-4 and 72,	George H. Gutteredge,	**Maynard,**	John F. Cleary,	2
– –	E. Eustis Bent,	**Medfield,**	G. L. L. Allen,	3
138,	Chas. E. Bacon,	**Medford,**	Hugh G. Kennedy,	2
6-2,	John B. Durfee,	**Medway,**	F. Hagar,	3
– –	– –	**Melrose,**	J. J. McCullough,	2
– –	Carl M. Taft,	**Mendon,**	F. M. Aldrich,	5
54-11,	Chas. R. Ford,	**Merrimac,**	Chas. R. Ford,	1
– –	George E. Douglas,	**Methuen,**	A. H. Wagland,	1
– –	John J. Fowler,	**Middleborough,**	John J. Fowler,	4

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
1,	George E. Cook,	**Middlefield,**	- -	-
63-14, Danvers,	L. G. Esty,	**Middleton,**	B. T. McGlauflin,	1
37-M,	E. G. Burke,	**Milford,**	P. F. Fitzgerald,	5
152-2,	H. L. Snelling,	**Millbury,**	E. F. Roach,	5
5-3,	Chas. LaCroix,	**Millis,**	Ralph L. Choate,	3
1442-25,	R. S. Carpenter,	**Milton,**	R. S. Carpenter,	3
1149-J, Woonsocket, R. I.	R. M. McLaughlin,	**Millville,**	Patrick Britt,	5
13-13, Readsboro, Vt.	Edw. C. Davis,	**Monroe,**	- -	-
12-12,	O. E. Bradway,	**Monson,**	Robert S. Fay,	5
14-4,	Thos. Verard,	**Montague,**	F. H. Gillette,	5
164-25,	Jasper H. Bills,	**Monterey,**	- -	-
3-24,	A. J. Hall,	**Montgomery,**	- -	-
17-6,	Howard Porter,	**Mt. Washington,**	- -	-
- -	- -	**Nahant,**	Herbert Coles,	1
16-3,	E. W. Francis,	**Nantucket,**	W. M. Voorneveld,	4
31 and 248-W,	W. H. Connelly,	**Natick,**	S. H. Hunnewell,	2
142,	H. H. Upham,	**Needham,**	George Twigg,	3
- -	Chas. S. Baker,	**New Ashford,**	- -	-
2280 and 353,	Edw. F. Dahill,	**New Bedford,**	C. F. Lawton,	3
6-4, Gilbertville,	Frank A. Morse,	**New Braintree,**	E. L. Havens,	5
13-6, Sheffield,	E. M. Stanton,	**New Marlborough.**	- -	-
10, Cobleyville,	Sewall V. King,	**New Salem,**	Sewall V. King,	5
1112-5,	Wm. P. Bailey,	**Newbury,**	Percy Oliver,	1
- -	Chas. P. Kelley,	**Newburyport,**	Chas. P. Kelley,	1
30, Newton South.	W. B. Randlett,	**Newton,**	W. W. Colton,	2
41-23,	S. C. Watson,	**Norfolk,**	Wm. A. Day,	3
205-W and 265,	H. J. Montgomery,	**North Adams,**	Jackson L. Temple,	5
1029-J,	Wm. L. Smith,	**No. Andover,**	Wm. L. Smith,	1
- -	H. W. Tufts,	**North Attleborough.**	F. P. Toner,	3
63-4,	Oscar C. Hirbour,	**North Brookfield,**	S. B. Colburn,	5
49,	George E. Eaton,	**North Reading,**	George E. Eaton,	2
165,	F. E. Chase,	**Northampton,**	Chas. A. Maynard,	5
12-11,	C. E. Bailey,	**Northborough,**	Harry Ellsworth,	5
182, Whitinsville,	W. E. Burnap,	**Northbridge,**	A. F. Whitin,	5
114-2,	Fred W. Doane,	**Northfield,**	F. W. Doane,	5
18-11,	George H. Storer,	**Norton,**	Wm. G. Briggs,	3
7-12,	J. H. Sparrell,	**Norwell,**	Fred M. Curtis,	4

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
417-M,	F. W. Talbot,	**Norwood,**	Wm. P. Hammersley.	3
89,	Frank W. Chase,	**Oak Bluffs,**	Frank F. Blankenship.	4
17-5,	C. H. Trowbridge,	**Oakham,**	C. H. Trowbridge,	5
232-12,	Wm. Walsh,	**Orange,**	Jas. W. Cooper,	5
33-2,	Jas. Boland,	**Orleans,**	A. Smith,	4
9-14,	D. A. Whitter,	**Otis,**	- -	-
9-5,	O. D. Vickers,	**Oxford,**	C. G. Larned,	5
53-W and 53-R,	J. Summers,	**Palmer,**	C. H. Keith,	5
1255-W, Cedar,	G. Van Wyck, Jr.,	**Paxton,**	H. S. Robinson,	5
- -	J. J. Callahan,	**Peabody,**	J. J. Callahan,	1
5-W, Amherst,	John H. Hubbard,	**Pelham,**	Marion E. Richardson.	5
83-3, Bryantville, 8015-4 Hanover.	J. J. Shepherd,	**Pembroke,**	Wm. C. Jones,	4
23-21,	G. N. Palmer,	**Pepperell,**	J. Tune,	2
11-2, Hinsdale,	Arthur Kilbourne,	**Peru,**	- -	-
61,	George Marsh,	**Petersham,**	Daniel Broderick,	5
176-6, Athol,	W. H. Cowlbeck,	**Phillipston,**	W. H. Cowlbeck,	5
834 and 535-M,	Chas. S. Kline,	**Pittsfield,**	- -	-
17-6,	E. H. Nye,	**Plainfield,**	- -	-
- -	Henry A. Boerger,	**Plainville,**	George H. Snell,	3
264,	Ira C. Ward,	**Plymouth,**	A. A. Raymond,	4
13-7, Kingston,	D. L. Bricknell,	**Plympton,**	D. L. Bricknell,	4
19-4, Cooleyville,	Fred W. Doubleday,	**Prescott,**	C. M. Pierce,	5
13-4,	F. W. Bryant,	**Princeton,**	F. A. Skinner,	5
49-11,	Jas. H. Barnett,	**Provincetown,**	F. G. Hill,	4
1,	Faxon T. Billings,	**Quincy,**	A. J. Stewart,	3
279,	R. F. Forest,	**Randolph,**	John Edw. Riley,	3
1161-W,	E. E. Chickering,	**Raynham,**	G. M. Leach,	3
518-W,	H. E. McIntyre,	**Reading,**	H. M. Donegan,	2
11-12,	B. F. Munroe,	**Rehoboth,**	Chas. B. Douglas,	3
- -	- -	**Revere,**	G. P. Babson,	1
8-2,	T. B. Salmon,	**Richmond,**	- -	-
12-32,	Daniel E. Hartley,	**Rochester,**	Samuel H. Corse,	4
55-X,	John H. Burke,	**Rockland,**	F. H. Shaw,	4
14-4,	John C. Martin,	**Rockport,**	F. A. Babcock,	1
22-6,	M. A. Peck,	**Rowe,**	- -	-
3-13,	Daniel O'Brien,	**Rowley,**	Chas. Curtis,	1
117-4, Athol,	L. G. Forbes,	**Royalston,**	E. S. Stewart,	5

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
2-12, . . .	S. S. Shurtleff, . .	**Russell,** . .	– –	–
13-4, . . .	H. Edw. Wheeler, .	**Rutland,** . .	H. E. Wheeler, . .	5
– –	– –	**Salem,** . . .	Wm. F. Cotter, . .	1
123-13, . .	Jas. H. Pike, . .	**Salisbury,** . .	H. C. Rich, . .	1
202-3, Winsted, Conn.	Chas. H. Strickland, .	**Sandisfield,** .	– –	–
76-2, . . .	J. R. Holway, . .	**Sandwich,** . .	Lincoln Crowell, .	4
346-W, . .	T. E. Berrett, . .	**Saugus,** . .	T. E. Berrett, . .	1
4-16, . . .	C. E. Tilton, . .	**Savoy,** . . .	– –	–
129-3, . . .	E. R. Seaverns, . .	**Scituate,** . .	Wm. F. Ford, . .	4
403-J-2, Pawtucket, R. I.	John L. Baker, . .	**Seekonk,** . .	C. A. Smith, . .	3
10, . . .	W. C. Morse, . .	**Sharon,** . .	Fred A. White, . .	3
26, . . .	A. H. Tuttle, . ʹ.	**Sheffield,** . .	– –	–
130-2, . . .	Chas. F. Dole, . .	**Shelburne,** . .	Chas. F. Dole, . .	5
– –	H. D. Eastman, . .	**Sherborn,** . .	Geo. W. Rock, . .	2
– –	A. A. Adams, . .	**Shirley,** . .	A. A. Adams, . .	2
– –	E. A. Logan, . .	**Shrewsbury,** .	Robt. C. Clapp, .	5
– –	Clarence N. Mellen, .	**Shutesbury,** . .	Wm. LaFogg, . .	5
928-M, . .	F. B. Butterworth, Jr.,	**Somerset,** . .	C. Riley, . . .	3
– –	– –	**Somerville,** . .	A. B. Prichard, .	2
22, . . .	Louis H. Lamb, . .	**So. Hadley,** .	Louis H. Lamb, .	5
151-14, . .	W. J. Lyman, . .	**Southampton,** .	C. S. Olds, . .	5
13, Marlborough,	Harry Burnett, . .	**Southborough,** .	Harry Burnett, .	5
11, . . .	Aimee Langevin, .	**Southbridge,** .	Aimee Langevin, .	5
35-3, . . .	B. M. Hastings, . .	**Southwick,** .	– –	–
53-2, . . .	Earl J. Potter, . .	**Spencer,** . .	G. Ramer, . .	5
20 and 98-5, Orchard.	F. C. Smith, . .	**Springfield,** .	Chas. E. Ladd, . .	5
5-12, . . .	J. T. Wilder, . .	**Sterling,** . .	J. H. Kilburn, . .	2
53-M, . . .	George Schneyer, .	**Stockbridge,** .	George Schneyer, .	5
176-W, . .	Albert J. Smith, .	**Stoneham,** . .	G. M. Jefts, . .	2
276-2 and 121-3, .	Fred H. Pye, . .	**Stoughton,** .	W. P. Kennedy, .	3
225-X, . .	W. H. Parker, . .	**Stow,** . . .	H. W. Herrick, . .	2
6-1, . . .	C. M. Clark, : .	**Sturbridge,** .	C. M. Clark, . .	5
5-4, . . .	Seneca W. Hall, . .	**Sudbury,** . .	W. E. Baldwin, .	2
46, South Deerfield.	A. C. Warner, . .	**Sunderland,** .	Richard Graves, .	5
58-4, . . .	R. H. Richardson, .	**Sutton,** . .	R. H. Richardson, .	5
1911-J, Lynn, .	Everett P. Mudge, .	**Swampscott,** .	Everett P. Mudge, .	1
468-W, . .	T. L. Mason, . .	**Swansea,** . .	A. E. Arnold, . .	3

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
1-320, ...	Fred A. Leonard, .	**Taunton,** . .	H. M. Briggs, . .	3
78-2, 78-3 and 30,	C. A. Fletcher, . .	**Templeton,** .	J. B. Wheeler, . .	5
4249-J, . .	H. M. Briggs, . .	**Tewksbury,** .	H. M. Briggs, . .	2
161-4, ...	E. C. Chadwick, .	**Tisbury,** . .	H. W. McLellan, .	4
269-7, ...	R. E. Clark, . .	**Tolland,** . .	- -	-
- -	T. Jesse Fuller, . .	**Topsfield,** . .	Harrison C. Ashley, .	1
70 and 51-2, .	F. J. Piper, . .	**Townsend,** . .	G. E. King, . .	2
- -	Walter F. Rich, . .	**Truro,** . . .	J. H. Atwood, . .	4
61-14, ...	Thos. Goodchild, .	**Tyngsborough,** .	C. J. Allgrove, . .	2
- -	George R. Warren, .	**Tyringham,** .	- -	-
15-2 and 8000, .	George Z. Williams, .	**Upton,** . .	Clarence L. Goodrich,	5
101, ...	H. W. Phoenix, . .	**Uxbridge,** . .	Willard Holbrook, .	5
59, ...	W. E. Cade, . .	**Wakefield,** . .	W. W. Whittredge, .	2
9-11 and 9-23, Brimfield.	L. H. Thompson, .	**Wales,** . . .	M. C. Royce, . .	5
107-2, ...	Jas. J. Hennessey, .	**Walpole,** . .	Philip R. Allen, .	3
6, ...	George L. Johnson, .	**Waltham,** . .	W. M. Ryan, . .	2
- -	M. J. Buckley, . .	**Ware,** . . .	F. Zeissig, . . .	5
45-23, ...	D. C. Keyes, . .	**Wareham,** . .	J. J. Walsh, . .	4
- -	Timothy M. Collins, .	**Warren,** . .	Alex A. Gendron, .	5
73-12, ...	C. A. Williams, . .	**Warwick,** . .	Chas. Bass, . .	5
12-4, Becket, .	Arthur L. Hayes, .	**Washington,** .	- -	-
116, Newton, North.	Van D. Horton, . .	**Watertown,** .	Van D. Horton, .	2
31-3, ...	Howard C. Haynes, .	**Wayland,** . .	D. J. Graham, . .	2
101-R, . . .	E. L. Wallis, . .	**Webster,** . .	C. Klebart, . .	5
9, ...	John P. Doyle, . .	**Wellesley,** . .	Thos. T. Watt, . .	3
- -	John Holbrook, . .	**Wellfleet,** . .	Wm. H. Gill, . .	4
74-31, Orange, .	C. F. White, . .	**Wendell,** . .	G. E. Mills, . .	5
74, ...	Jacob D. Barnes, .	**Wenham,** . .	J. E. Kavanagh, .	1
- -	E. J. Burpee, . .	**West Boylston,** .	Harry E. Lowe, .	5
- -	W. P. Laughton, .	**W. Bridgewater,** .	O. Belmore, . .	4
114-3, ...	John H. Webb, . .	**W. Brookfield,** .	John H. Webb, . .	5
- -	Louis H. Flook, . .	**W. Newbury,** .	Frank D. Bailey, .	1
6961-J and 1504, .	E. B. Jones, . .	**W. Springfield,** .	George W. Hayden, .	5
8010, ...	B. P. Bissell, . .	**W. Stockbridge,** .	- -	-
92-3, ...	Wm. J. Rotch, . .	**West Tisbury,** .	Jerry B. Mayhew, .	4
153-12, . . .	T. W. Humphrey, .	**Westborough,** .	George E. Hayden, .	5
111-Y, . . .	Thos. H. Mahoney, .	**Westfield,** . .	- -	-

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
44-11,	H. L. Nesmith,	**Westford,**	H. L. Nesmith,	2
1482-2, East-hampton.	Myron M. Clapp,	**Westhampton,**	- -	-
1-3,	W. F. Neal,	**Westminster,**	G. A. Sargent,	5
1329-M,	B. R. Parker,	**Weston,**	E. P. Ripley,	2
41-31,	Frank Whalon,	**Westport,**	Christopher Borden,	3
- -	E. E. Smith,	**Westwood,**	Martin Sorenson,	3
185,	W. W. Pratt,	**Weymouth,**	C. L. Merritt,	3
39-14,	John H. Pease,	**Whately,**	Rylan C. Howes,	5
249-W,	C. A. Randall,	**Whitman,**	C. A. Randall,	4
1-4,	Henry I. Edson,	**Wilbraham,**	Henry I. Edson,	5
8011-2,	John L. Brown,	**Williamsburg,**	- -	-
329-W,	W. H. Davies,	**Williamstown,**	Wm. H. Davies,	5
28-2,	Oliver McGrane,	**Wilmington,**	Oliver McGrane,	2
102-4,	Theron C. Flint,	**Winchendon,**	Benj. Sepka,	5
- -	David DeCourcy,	**Winchester,**	S. S. Symmes,	2
201-12,	Amos S. Ferry,	**Windsor,**	- -	-
- -	- -	**Winthrop,**	Harry Hills,	1
- -	Frank E. Tracy,	**Woburn,**	H. V. Macksey,	2
7137, Park,	W. N. Avery,	**Worcester,**	Thos. E. Holland,	5
10-22,	Chas. A. Kilbourn,	**Worthington,**	- -	-
69,	George H. E. Mayshaw,	**Wrentham,**	H. Gilmore,	3
58-31, Barnstable,	J. W. Hamblin,	**Yarmouth,**	John R. Eldredge,	4

SUMMARY OF RECOMMENDATIONS.

1. That the General Court appropriate for the use of the State Forester sufficient funds to enable him to begin the planting and development of State forests.

2. Past experience makes it clear that in order to deal more effectively with the forest-fire evil more stringent rules and regulations governing the disposal of slash or brush should be enacted into law.

3. The enactment of a law prescribing the manner of measuring wood when sold or offered for sale in a form other than 3 or 4 foot lengths, and the further regulation of the sale of cordwood.

4. That provision be made by law for extending financial aid to certain towns in the extinguishment of forest fires.

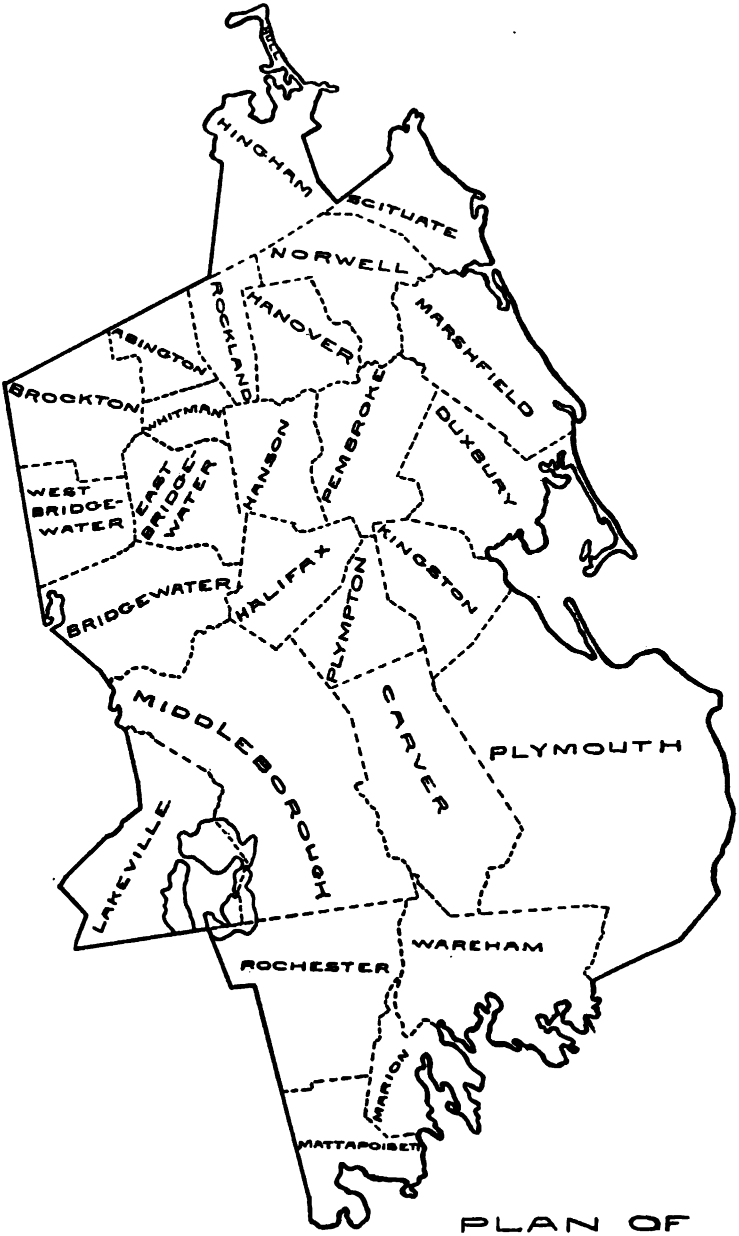
F. W. RANE,
State Forester.

THE FORESTS
PLYMOUTH COUN

MASSACHUSETTS STATE FOREST

1918

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRIN
32 DERNE STREET
1918



PLAN OF
PLYMOUTH COUNTY

THE FORESTS OF PLYMOUTH COUNTY

The Results of a Forest Survey

OF THE

Twenty-seven Towns in the County

By JAMES J. MORRIS

Under the direction of F. W. RANE, State Forester

MASSACHUSETTS STATE FORESTER, 1918

BOSTON
WRIGHT & POTTER PRINTING CO., STATE PRINTERS
32 DERNE STREET
1918

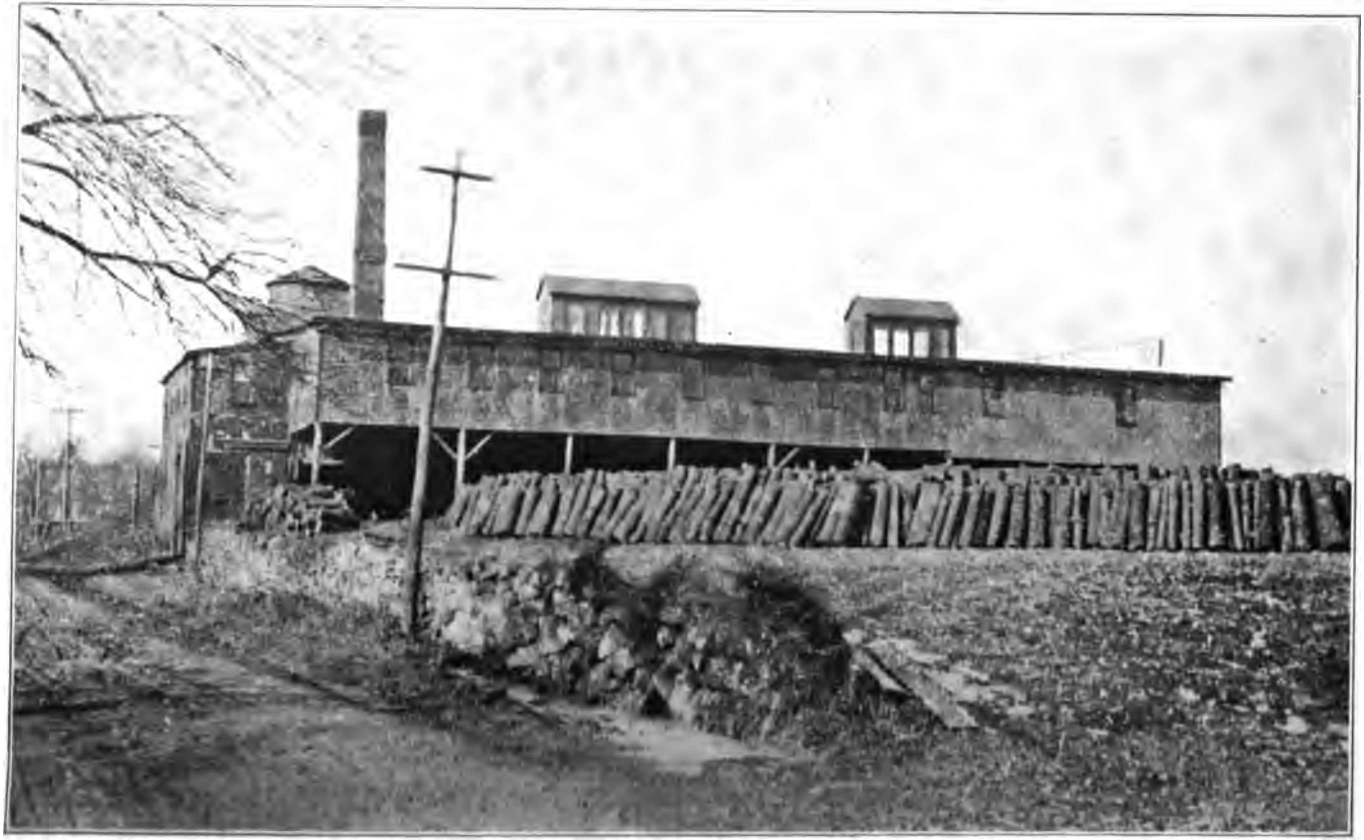
Publication of this Document
approved by the
Supervisor of Administration.

FOREWORD.

We are presenting herewith the results of the forest survey of Plymouth County, the second county to be so studied. The field work of collecting the data here included was carried out under the general direction of Mr. P. D. Kneeland, M.F., assistant forester in charge of utilization, while the crew in the field was in charge of Mr. H. E. Henshaw. The work of compilation and of arranging the data in the form of a bulletin was undertaken by Mr. James J. Morris.

The facts developed in these county surveys are now tabulated for the first time, and cannot be arrived at in any other manner. It is believed that they will prove valuable to those interested in our present and future forestry development.

F. W. RANE,
State Forester.



Plymouth County saw mill.

THE FORESTS OF PLYMOUTH COUNTY.

EXPLANATION OF SURVEY.

The survey of the several towns of Plymouth County is the second work of this kind attempted by the State forestry department. The other survey, that of Worcester County, was carried on at odd times, and extended over a period of three years. The data were collected and published last winter in the form of a bulletin, which was entitled "The Forests of Worcester County."

In the Worcester County bulletin the reasons for making forest surveys of the different counties of Massachusetts were explained in detail, but it will not be amiss here to review briefly some of the main reasons.

Every manufacturing concern or business of any kind at some time or other takes an inventory of its stock. Without such an inventory no business can be carried on to the best advantage. The stock, or raw material, of forestry work is forest land, and since the State forestry department of Massachusetts is just what its name implies, the raw material with which this department must deal is the forest lands of Massachusetts.

If the woodlands of Massachusetts were made up of but one or two species of trees, or if the various species of trees were all of the same height or diameter size, this inventory would be a comparatively simple matter. But such conditions do not exist. Scattered throughout the State are many different kinds of trees differing greatly in importance, value, life habits, etc., from each other. Moreover, since the woodlands have been repeatedly cut over at different times for many years, we find existing a variegated collection of trees of all sizes and conditions; in fact, nearly every woodlot differs to a greater or less extent from others.

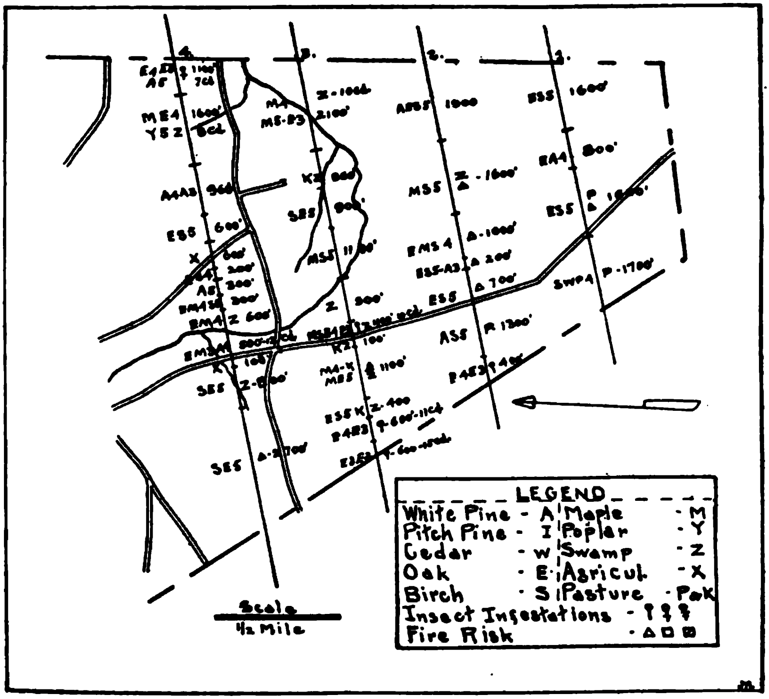
METHOD OF SURVEY.

In Worcester County each town was covered by one man, who did all the field work. In Plymouth County the men worked in a crew, each man covering a certain assigned section of the town which was being mapped. When one town was finished the men moved on to the next. There were several distinct advantages in this arrangement. Since the men camped in tents it was possible for them to choose a central location for their camp site and thus save time, inasmuch as in going to and from their work they were not obliged to cover the same ground as they would have been had they stopped at a farmhouse or hotel in one corner of the town, as was often the case in Worcester County. The cost of the survey was also lighter, the only expense incurred being for foodstuffs, since the men and camp equipment were moved from place to place by one of the department trucks.

For the main part, however, the methods followed in making this survey were similar to those followed in Worcester County. The men worked by compass and pace, using a copy of the United States topographical map as a guide map for each town. Each man would start at some convenient point on a road or edge of a pond and run a straight line through to the town line and then back to the opposite town line on a course parallel to the first, but one-half mile distant. Care was taken when laying off these parallel lines to have them cut the roads so far as possible; that is, if the majority of the roads in a certain town ran in an easterly and westerly direction the strips were run in a northerly and southerly direction, or *vice versa.* Cutting the roads in this manner enabled the men to get a truer idea of the actual forest conditions, and it was possible to obtain a more accurate average, because if the strips were run in the general direction of the roads some of them would parallel the roads, and since in most cases the type found along the roadsides, which is largely tillage, is not typical of the land lying a few hundred feet farther in, the data obtained in this way would not be trustworthy, as the lines would show an amount of farm and tillage land out of proportion to actual conditions.

For convenience and brevity in the field, symbols representing the various types, diameter classes, moth infestations, etc., were used. These symbols are somewhat similar to those used in the previous survey. The map work of each town has been completed, and photographic enlargements of the topographical maps used as a base are to be found at the office of the State Forester. These maps show the strip lines which were run in each town, and contain a symbolic explanation of the different types, size classes, etc. Tables containing summaries computed from the information obtained from the field work are contained in this bulletin.

The following diagram may serve to illustrate the method used in making this survey: —



Map of northern section of Rockland, showing method of survey.

Lines 1, 2, 3 and 4, running approximately east and west, represent strip lines one-half mile apart. On Line 1, and near the top of the plate, are the symbols "E S 5, 1600′." Consulting the legend we learn that along this line for a distance of

1,600 feet were found oak and birch of sprout size in mixture, the number 5 representing the size class. Oak predominates, since the letter "E," representing oak, precedes the letter "S," representing birch.

FOREST TYPES.

On account of the difference in topographical and climatic conditions, the types of Plymouth County vary to a considerable extent from those of Worcester County. Following is a list of types used and a brief explanation of each: —

White Pine. — This type consists of white pine in pure stands, that is, in stands made up of 80 per cent. or more of the one species. There is still a considerable amount of this type found throughout the county in spite of repeated cuttings and fires. It may be safely stated that there are several million feet of this type of good merchantable size, although it is somewhat scattered and found as a rule in stands of small areas.

Pine and Oak. — Stands of this kind are made up of 70 per cent. or more of white pine and oak in mixture. It is a common type. Sometimes the proportion of oak is greater than that of pine, while at other times there is about an equal amount of each. In all cases, however, the oak and pine in combination form at least 70 per cent. of the total stand, the remainder being made up of maple, pitch pine and unimportant hardwoods. This type is generally found on the higher gravelly lands.

Pine and Maple. — Substituting maple for the oak, this type is similar to the preceding. It is not so common as that of the pine and oak, and is generally found in low or swampy lands.

Oak. — This forms the largest type. It embraces stands made up of 80 per cent. or more of oak. A very large proportion in size class 5 is made up of the so-called scrub oak. More than one-half of the total for the county is of a diameter size too small for cordwood. There is, however, a considerable amount large enough for saw-logs.

Maple (Swamp Type). — Consists of nearly pure stands of maple. This type is found on low, wet land, and is fairly common. A good proportion is made up of species of cordwood size, with a moderate representation of the larger size classes.

Pitch Pine Type. — Next to the oak this is the largest individual type found. It is found in all size classes, but more than 50 per cent. consists of the No. 5, or smallest, class. It is often found in pure stands, but generally contains some other tree in mixture. Scrub oak is its most common associate.

SIZE CLASSES.

In the Worcester County survey but four size classes were used. As an experiment it was decided in the Plymouth survey to split the No. 4 size in two, thus forming five size classes, and differentiating the small brush from saplings. Except for forestry purposes, such as determining more exactly the type of land on which planting might be done without preliminary brushing, the result does not warrant the distinction.. Following is an explanation of the various classes: —

No. 1 forms the largest size class, and contains species whose diameters breast high average 10 inches or better, and whose height will average 60 to 80 feet.

No. 2 represents trees whose average diameters run from 8 to 10 inches, and whose height will average about 50 to 70 feet.

No. 3 constitutes the cordwood size, and species of this class average about 5 inches in diameter and 40 to 50 feet in height.

No. 4 embraces saplings and small cordwood, or thrash. Trees falling in this diameter class average about 2 inches in diameter and 30 to 40 feet in height.

No. 5 is formed of very young sprout or stunted growth, such as scrub oak, stunted pitch pine, etc. In no case do the diameters run higher than 2 inches.

NON-FOREST TYPES.

Tillage and Hay. — Land covered by this heading is all under cultivation. Included in this type is all the farming and agricultural land, with the exception of pasture and cranberry bogs.

Pasture. — In the Worcester survey much land which could not be classed exactly as No. 5 forest type, owing to the small amount of wood growth on it, and yet which was not actually used as grazing land, was classed as brush pasture.

In this survey the heading "Pasture" includes only such lands as are actually used as such. This accounts to a certain extent for the great difference in the pasture totals of Worcester and Plymouth counties.

Water. — All inland waters fall under this classification: ponds, lakes, rivers and brooks. The figures are a little lower than those of the Waterways Commission, but considering the necessarily rough method in which they were obtained the results are very satisfactory.

Residential. — This term explains itself. It also includes business sections, cemeteries, fair grounds, etc.

Cranberry Bog. — Much of the low, mucky lands along streams is suitable for the raising of cranberries, and advantage has been taken of this fact. The area covered by these bogs, although almost negligible as compared to the total area of the county, is, nevertheless, worthy of mention because of the importance of the product.

Marsh. — This term has been used to cover two distinct types. In seacoast towns it applies to salt marsh, while in inland towns it covers the open swamps.

PLYMOUTH COUNTY.

Plymouth County lies in the southeast corner of Massachusetts, just north of Cape Cod. It contains approximately 440,000 acres. Plymouth, a town of about 13,000 population, situated on the coast in the central and eastern part, is the county seat. Brockton is the commercial center, and is important from an industrial standpoint. Other important towns are Middleborough, Whitman, Bridgewater and Rockland. All of these towns contain manufactories of various kinds, principally shoes.

In the western part the Cape Cod branch of the New York, New Haven & Hartford Railroad runs in a northerly and southerly direction the entire length of the county, while another branch follows the eastern coast line as far south as Plymouth. A line of the same road running east and west connects Plymouth and Middleborough, and in the north a connecting line runs to Plymouth. Electric roads traverse the county in various directions, connecting all the principal cities and towns. On the whole, it may be said that the railroad facilities in the county are good, except in the southern part.

The products of the county are many and varied. Among the most important may be mentioned shoes, rope, cotton cloth, rubber products, boxes, crates, shooks and shoemaking tools.

The important farming products are hay, potatoes, cranberries and miscellaneous vegetables. Dairying is not now a very important industry, and is becoming less so year after year. Stock and poultry raising is practiced to a slight extent.

Along the seashore are many fine summer resorts. Hundreds of fine residences have been built, and these resorts are constantly attracting people in larger numbers to enjoy the ocean scenery for which the shores of eastern and southern Plymouth County are justly famous.

Topography and Soils.

Running practically the entire eastern length of the county, along the coast, and extending inland roughly about 5 miles, is a strip of rolling, knobby land with basin-like intervales. The hills are mostly rounded, irregular of distribution, and in very rare cases rise beyond 100 feet in altitude. This strip is made up of a terminal moraine, and is more rugged than the other sections of the county.

The remainder, which means practically the whole of the county, is made up of a level to gentle rolling topography. The elevation of the hills ranges from 100 to 200 feet. Numerous ponds abound, among the principal of which may be mentioned Assawompsett, Long Pond and Quittacas, all situated mainly or in part in the town of Lakeville. Several swamps of large areas also occur, the Great Cedar Swamps of Bridgewater and Middleborough being the most important.

The drainage of the county is effected mainly through several small rivers and their tributaries. The Weweantic River drains to the south into Buzzards Bay. The Taunton River, emptying into Mount Hope Bay, drains part of the western and central areas. Weir and Fresh rivers are the principal streams in the north, while North, South and Jones rivers drain to the east. Other important streams are the Mattapoisett, Wankinco, Agawam and Sippican. Many of the ponds and lakes throughout the county have no apparent outlet, and it is possible, particularly so in the eastern section, that they empty into the ocean through a subterranean flow which drains to a considerable extent the whole country.

Monk's Hill in Kingston is the highest elevation in the county.

The soils of the northern part of Plymouth County are mostly a light to heavy fine sandy loam, with outcroppings of granite, gneiss and schist. Much of this soil is forested, but that which is cultivated produces good and various crops. The sandier and stony types are found mostly in pastures.

Although the larger part of the soils of the central and southern sections are also sandy loam, they are coarser than those of the northern section, and carry a considerable amount of gravel and fine pebbles. Through Plymouth, Wareham and Middleborough deposits of muck occur. This soil is used extensively for growing cranberries, and, as shown in the tables, quite a sizable area is under cultivation.

Forest Conditions.

In the reports of the overseers of the earlier Plymouth County settlements reference is often made to the forests, but such references contain very scanty information as to their composition. It is probable, however, that at the time of the landing of the Pilgrims the greater part of the county was forested with large and thrifty virgin stands of white and pitch pine, oak and maple, — pine in uplands, oak and maple in lowlands.

We know that much of the pine was cut and shipped to England to be used for masts for the English navy, and also that England depended to a large extent upon New England pitch pine for her naval stores.

The original forest types exist to-day, but in a much depleted condition. Over large areas fires have swept repeatedly, burning off the humus — the forest floor covering — and greatly impoverishing the soil in many sections. From these fire-swept areas the original white or pitch pine stands have disappeared, and in their places are growths of scrub pitch pine and oak.

Throughout the greater portion of the county, however, white pine can be grown, and areas now given over to scrub oak should be reforested. On the sandier areas Scotch and good grade pitch pine could be grown with success. In fact, reforestation has been carried on successfully in nearly all parts of the county. The State Forest Commission has recently acquired a tract of several thousand acres of land in the town of Carver, and this department is planting large quantities of white and Scotch pine there every year.

As mentioned above, white pine of good grade is still found in fair quantities and in pure stands distributed throughout the county.

It may be well to regard briefly the distribution of the various types. Practically all of the types are universally distributed, and in nearly every case all of the various size classes are found in each town.

The towns of Bridgewater, Hingham and Pembroke contain the highest percentages of white pine, while Abington, Plymouth, Rockland, Wareham and West Bridgewater contain the smallest. Good stands of the first quality may be found in all the towns, but Whitman, Scituate, Abington and Hanover are poorest in this respect. It may be stated here that these towns contain very little of the best quality of any of the different types.

Plymouth shows the highest proportion of forested land (82.5 per cent.), but there are several other towns containing 70 per cent. or more of forest growth. These towns are Carver, Hanover, Hanson, Kingston, Lakeville, Marion, Mattapoisett, Middleborough, Norwell, Pembroke and Plympton.

Brockton, Hingham, Marshfield, Scituate and Whitman have the smallest percentages of wooded areas.

The best oak is found in largest proportional quantities in Marion, Mattapoisett, Middleborough, Plymouth, Rochester and Scituate.

Maple is found mostly in cordwood sizes, but stands of first-class stock may be found in Lakeville, Marion, Mattapoisett, Middleborough, Norwell, Pembroke, Rochester and Scituate.

The best stands of pitch pine occur in Carver, Duxbury, Kingston, Mattapoisett, Marion, Plymouth, Rochester and Wareham, all seacoast towns with the exception of Carver and Rochester, which are sandy plains.

Of the non-forest types West Bridgewater contains the highest proportion of agricultural land. Others of the larger cultivated areas are Bridgewater, East Bridgewater, Hanover, Hingham, Scituate and Whitman.

Brockton and Whitman contain the largest proportional residential areas, although Plymouth and Middleborough have actual residential areas larger than Whitman.

Abington, Whitman and Hingham contain the largest proportional amount of pasture land.

Marshfield, Marion and Carver have large amounts of marsh land, Marshfield, as the name suggests, having by far the greatest area of this salt marsh.

The largest and best cranberry bogs are found in Carver and Wareham, while Lakeville contains more actual water area than any other town in the county.

Moth Infestation.

Since Plymouth County contains such a proportionately large amount of oak as compared to other sections of the State, we would naturally draw the conclusion that the moth infestation must be exceptionally large. This, however, is not true. Conditions here, with the exception of the town of Plymouth, are not much worse than those throughout the eastern part of Massachusetts, and at the present time the moth situation is such that, with careful supervision and a reasonable expenditure of money for spraying purposes, it may be kept well under control.

There are, however, large tracts of land forested with oak of poor quality, not large enough for cordwood and with little chance of being so for some years to come, that present a serious problem. These lots, most of them located in the southern part of the county, are situated far away from the centers, and on account of the poor quality of the wood, and its distance from a market, spraying is out of the question because of the expense entailed. These lots should be clean brushed and reforested with white or Scotch pine. The State forestry department has not at the present time the money to do this work, and anything that is attempted along this line must be done by the owners of the lands in question.

Forest Fire Protection.

The destructive fires which have raged over the entire Cape country, including the southern part of Plymouth County, have caused very serious damage to forest growth. Indeed, fire has been the most serious enemy of timber propagation in this section. The geographic location of this part of the State, together with the high winds which prevail at certain periods of the year, are conditions which make each small brush fire a potential holocaust.

This fire menace has been recognized for a long time by the residents of the Cape counties and by the State Forester's department. A fire tower was constructed in Plymouth by that town in 1905. In 1911 the office of State Fire Warden was established, and since then towers have been erected on high points in the towns of Kingston, Hanson, Hingham and Middleborough. These towers, with the addition of that in Bourne in Barnstable County, now cover the entire area of Plymouth County, and statistics from the State Fire Warden's reports show that the fire damage in this section has been reduced about 75 per cent. since their erection.

Forest Industries.

The shoe manufacturing and cranberry raising industries require very large amounts of wood in the manufacture of boxes, crates and barrels for the shipment of their products. Practically all of the wood used is obtained from the county. In nearly every town may be found mills which saw 100,000 board feet or more of pine and oak each year. Many of these mills turn out the finished product, — boxes, crates, or barrels, as the case may be, — but a considerable number simply supply the boards, while others deliver their product in the form of shooks. The logs in almost all cases are cut short and bought locally by the cord, and are sawn into ⅝-inch boards, which is the standard dimension for box boards.

In addition to the manufacture of boxes, etc., several of these sawmills do custom work, but there is nowhere near so much of this done now as in former years.

In one important respect the sawmills of Plymouth County differ from those located in other parts of the State. They are permanent. Logs are hauled to them by truck or shipped by rail. Were it not for the many destructive fires, the fact that these mills are permanent ones might have had a powerful effect in influencing the forest types..

Before a portable mill owner sets up his mill on a lot he must be sure that there are at least 200,000 feet of stock in the immediate vicinity that he can cut. Moving and setting up his mill to cut under that amount would hardly pay him unless the stock was exceptionally good.

When large tracts of land are cut over a change in forest conditions naturally results. New species, generally hardwoods, take the place of the old. These hardwoods, which grow very rapidly during their earlier years, shade and choke out the young reproduction of the conifers recently cut, and after a few years a stand of hardwoods, often of inferior quality, occupies the land formerly forested with pine or other valuable trees.

Where the mills are permanent, as in Plymouth County, the owner of a woodlot is not obliged to cut his lot clean. He can take out a few trees one year, haul them to the mill, and the following year cut out a few more.

When a stand is cut gradually in this way the type undergoes no serious change, since the reproduction is generally the same as the original trees.

To sum up the whole thing in a few words, permanent mills foster a system of selective cutting, and have a tendency to preserve the original species and types, while portable mills in many cases, through clean cutting, bring about a decided change in both.

Poplar makes an ideal wood for staves, and as an experiment the State Forest Commission has set out about 40,000 poplar cuttings on the State reservation in Carver.

White pine is the species most used in the manufacture of box boards, but of late years pitch pine is being substituted to some extent.

Stock for barrel staves is in some cases shipped from outside the State, some of it being loblolly pine from Virginia. Much of the stock, however, is obtained locally, and consists of pine and poplar with oak and maples for headings. Oak is used in the manufacture of piling and mine props. These products are used in the construction of docks, wharves, etc.

No attention has been given to cedar in the various tables, but nevertheless quite a little of this species is found in isolated sections of the county, and generally in swamps. This wood is used in the manufacture of shingles, and on rare occasions for barrels. It is also used for posts and poles.

The manufacture of lobster pots may be classed as a special industry. Oak and white pine are used in this product, and there are several concerns engaged in their manufacture.

Some years ago charcoal was produced in large quantities in various parts of Plymouth County. This industry has practically disappeared. Last year this department undertook the manufacture of charcoal as an experiment in the town of Mashpee. The lot was made up entirely of oak of poor quality and small size class, and the wood was too far away from a market to be put profitably into cordwood. Three pits were maintained, and about 40,000 bushels of charcoal were produced. It was thought that charcoal made from oak would not sell readily, but no trouble was experienced in disposing of the entire production in near-by towns; in fact, double the quantity could easily have been gotten rid of. In this experiment about 40 bushels of charcoal were produced from each cord of wood.

Mashpee is not a town in Plymouth County, and therefore these remarks are somewhat irrelevant, but they are made because of the fact that scattered throughout Plymouth County are hundreds of acres of scraggly oak and pine too far away from a market to be cut profitably for fuel, which the results of the experiment cause us to believe could be burned for charcoal and disposed of for at least a small profit. So far as we know there is but one man in the county engaged in the manufacture of charcoal at the present time. A bulletin containing more detailed information in regard to this experiment will be issued from the office of the State Forester in the near future.

Other forest products of Plymouth County are pin wood, mallet heads, ship timbers, wagon stock and hardwood rollers.

In this bulletin is included a list of the sawmill operators of the county, which gives information regarding their production, stock used, etc. This list is as complete as it was possible for us to make it in the limited time we had at our disposal.

Following are the percentage sheets of 26 towns in the county. The town of Hull was not considered at all in making the survey, as there is not enough wood growth there to warrant it. These tables show the proportion of forest land to non-forest land, and also the relative proportions of the individual types of the forested areas. The tables alone could not be made to show the proportion of the separate type size classes, so they have been supplemented by diagrams from which may be formed an idea of the relative amounts of merchantable and non-merchantable timber of each type in each town. In these diagrams the proportion of non-merchantable sizes is represented by the inked portion of each line.

In arranging these diagrams size classes 1 and 2 of the white pine and pitch pine types were combined and classed as merchantable, while in the remainder of the types classes 1, 2 and 3 were combined and classified in the same way. The remainder of the size classes was combined in each type and classed as non-merchantable. It will be noticed from this explanation that in the case of the hardwoods and mixed hardwoods and pine, class 3, or cordwood class, has been listed as merchantable, while in the case of the pines only classes 1 and 2, containing lumber large enough for saw logs, were so listed.

FOREST TYPES AND ACREAGE IN 26 TOWNS IN PLYMOUTH COUNTY.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	4,184	5,862	6,439	3,747	2,126	22,358	7.4	-
Pine and oak,	6,612	8,678	18,529	15,004	8,930	57,753	19.0	-
Pine and maple,	2,362	3,654	5,613	3,593	836	16,058	5.3	-
Oak type,	5,337	9,956	24,615	30,669	24,321	94,898	31.2	-
Maple type,	1,101	6,282	15,048	19,215	5,652	47,298	15.5	-
Pitch pine type,	1,879	4,126	8,501	11,271	39,991	65,768	21.6	-
Total,	21,475	38,558	78,745	83,499	81,856	304,133	-	69.1
Per cent.,	7.1	12.7	25.8	27.5	26.9	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						67,612	-	15.3
Pasture,						16,607	-	3.8
Residential,						18,565	-	4.2
Water,						14,101	-	3.2
Cranberry bog,						8,550	-	1.9
Marsh,						10,998	-	2.5
Total area of 26 towns,						440,566	-	100.0

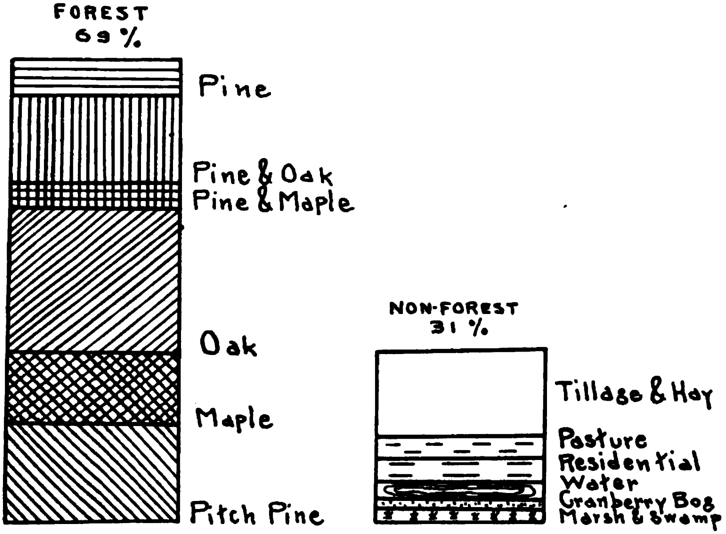
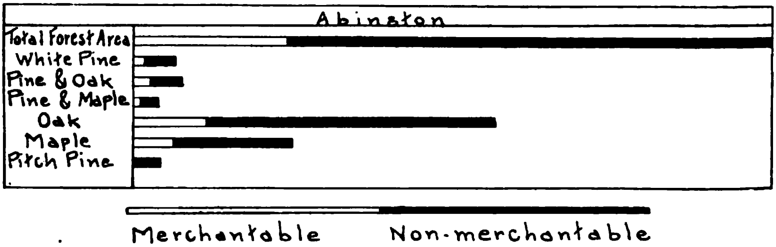


DIAGRAM SHOWING PROPORTION OF LAND TYPES FOUND IN PLYMOUTH COUNTY.

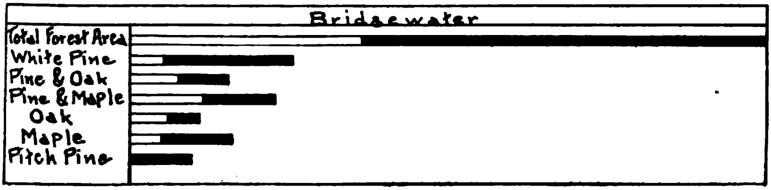
ABINGTON.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	-	50	56	63	-	169	4.6	-
Pine and oak,	-	31	38	-	182	251	6.9	-
Pine and maple,	38	-	19	75	-	132	3.6	-
Oak type,	-	63	427	251	1,330	2,071	56.6	-
Maple (swamp type),	-	44	182	414	257	897	24.5	-
Pitch pine,	-	-	-	25	113	138	3.8	-
Total,	38	188	722	828	1,882	3,658	-	56.4
Per cent.,	1.1	5.2	19.7	22.6	51.4	-	100.0	-
Non-forest Types.								
Tillage and hay,						1,263	-	19.5
Pasture,						702	-	10.8
Residential,						709	-	10.9
Water,						100	-	1.5
Marsh,						56	-	.9
Total area of town,						6,488	-	100.0



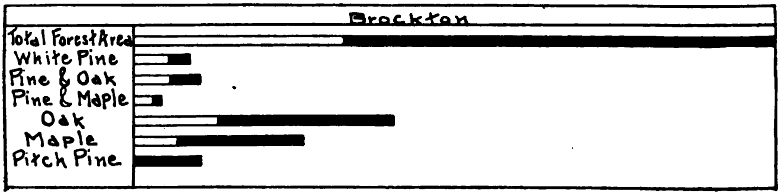
BRIDGEWATER.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	202	185	330	174	856	1,747	15.4	-
Pine and oak,	121	318	659	572	885	2,555	22.6	-
Pine and maple,	46	64	532	376	185	1,203	10.6	-
Oak type,	115	445	492	416	382	1,850	16.3	-
Maple (swamp) type,	40	162	625	1,319	752	2,898	25.6	-
Pitch pine,	-	-	23	87	972	1,082	9.5	-
Total,	524	1,174	2,661	2,944	4,032	11,335	-	62.9
Per cent.,	4.6	10.3	23.5	26	35.6	-	100.0	-
Non-forest Types.								
Tillage and hay,						4,346	-	24.1
Pasture,						839	-	4.7
Residential,						544	-	3.0
Water,						515	-	2.9
Marsh,						434	-	2.4
Total area of town,						18,013	-	100.0



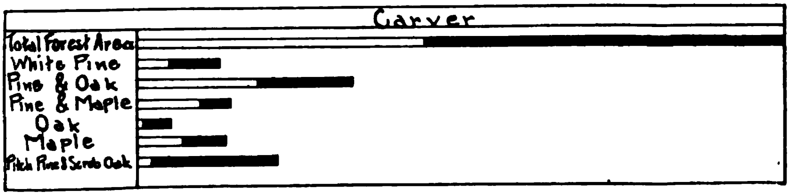
BROCKTON.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	130	161	78	52	150	571	8.5	-
Pine and oak,	114	161	171	192	62	700	10.4	-
Pine and maple,	-	83	150	-	52	285	4.2	-
Oak type,	130	228	638	830	907	2,733	40.5	-
Maple (swamp) type,	-	119	342	767	539	1,767	26.2	-
Pitch pine,	-	-	-	83	601	684	10.2	-
Total,	374	752	1,379	1,924	2,311	6,740	-	49.1
Per cent.,	5.6	11.1	20.5	28.5	34.3	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						2,411	-	17.5
Pasture,						716	-	5.2
Residential,						3,733	-	27.1
Water,						21	-	.2
Marsh,						124	-	.9
Total area of town,						13,745	-	100.0



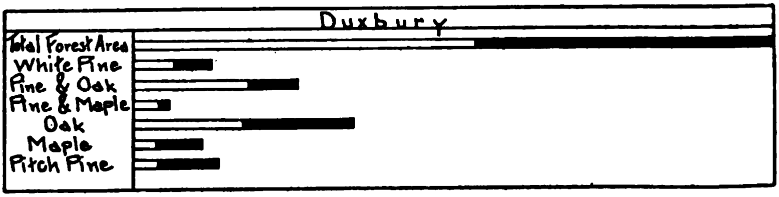
CARVER.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	302	604	685	705	-	2,296	12.4	-
Pine and oak,	-	1,281	2,260	2,621	-	6,162	33.2	-
Pine and maple,	163	1,016	846	622	-	2,647	14.3	-
Oak type,	36	24	65	812	-	937	5.1	-
Maple (swamp) type,	24	496	729	1,257	-	2,506	13.5	-
Pitch pine,	-	314	500	3,181	-	3,995	21.5	-
Total,	525	3,735	5,085	9,198	-	18,543	-	73.2
Per cent.,	2.8	20.1	27.4	49.7	-	-	100.0	-
Non-forest Types.								
Tillage and hay,						1,667	-	6.6
Pasture,						667	-	2.6
Residential,						121	-	.5
Water,						761	-	3.0
Cranberry bog,						3,574	-	14.1
Total area of town,						25,333	-	100.0



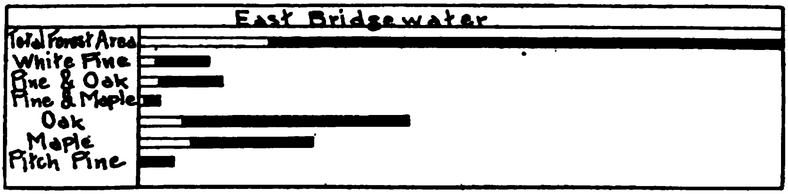
DUXBURY.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	444	233	391	42	127	1,237	11.7	-
Pine and oak,	317	550	1,004	581	222	2,674	25.3	-
Pine and maple,	63	95	275	127	-	560	5.3	-
Oak type,	254	412	1,216	1,164	560	3,606	34.1	-
Maple (swamp) type,	-	201	180	729	-	1,110	10.5	-
Pitch pine,	53	359	349	307	317	1,385	13.1	-
Total,	1,131	1,850	3,415	2,950	1,226	10,572	-	67.4
Per cent.,	10.7	17.5	32.3	27.9	11.6	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						2,729	-	17.4
Pasture,						784	-	5.0
Residential,						847	-	5.4
Water,						314	-	2.0
Cranberry bog,						408	-	2.6
Marsh,						31	-	.2
Total area of town,						15,685	-	100.0



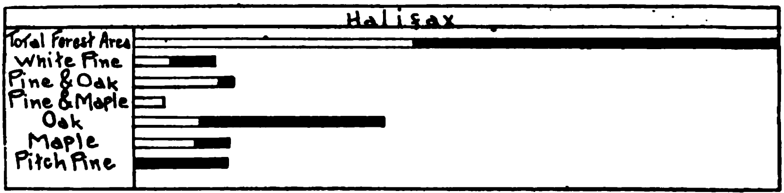
EAST BRIDGEWATER.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	75	98	230	310	17	730	10.6	-
Pine and oak,	-	40	184	252	396	872	12.7	-
Pine and maple,	-	-	52	149	-	201	2.9	-
Oak type,	34	120	287	1,308	1,130	2,879	41.8	-
Maple (swamp) type,	23	161	361	689	625	1,859	26.9	-
Pitch pine,	-	-	11	-	339	350	5.1	-
Total,	132	419	1,125	2,708	2,507	6,891	-	60.8
Per cent.,	1.9	6.1	16.3	39.3	36.4	-	100.0	-
Non-forest Types.								
Tillage and hay,						3,284	-	28.9
Pasture,						648	-	5.7
Residential,						270	-	2.4
Water,						143	-	1.3
Marsh,						103	-	.9
Total area of town,						11,339	-	100.0



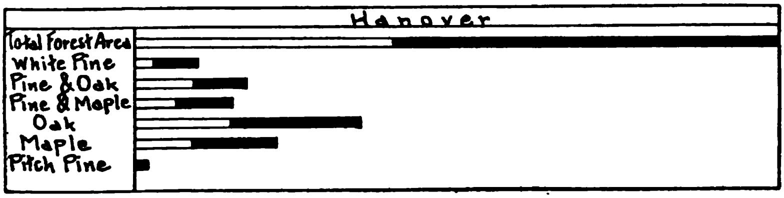
HALIFAX.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	139	278	285	110	102	914	12.5	-
Pine and oak,	22	22	922	-	146	1,112	15.2	-
Pine and maple,	-	102	241	-	-	343	4.7	-
Oak type,	-	66	666	878	1,222	2,832	38.7	-
Maple (swamp) type,	-	44	644	322	51	1,061	14.5	-
Pitch pine,	-	-	-	-	1,053	1,053	14.4	-
Total,	161	512	2,758	1,310	2,574	7,315	-	65.8
Per cent.,	2.2	7	37.7	17.9	35.2	-	100.0	-
NON-FOREST TYPES.								
Tillage,						1,857	-	16.7
Pasture,						278	-	2.5
Residential,						89	-	.8
Water,						889	-	8.0
Cranberry bog,						222	-	2.0
Marsh,						467	-	4.2
Total area of town,						11,117	-	100.0



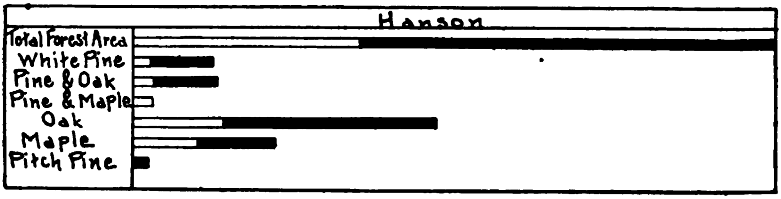
HANOVER.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	13	205	271	221	-	710	9.6	-
Pine and oak,	-	33	545	678	-	1,256	17.0	-
Pine and maple,	-	20	443	638	-	1,101	15.0	-
Oak type,	-	53	1,044	1,481	-	2,578	35.0	-
Maple (swamp) type,	-	46	588	978	-	1,612	21.8	-
Pitch pine,	-	-	59	66	-	125	1.6	-
Total,	13	357	2,950	4,062	-	7,382	-	73.8
Per cent.,	.2	4.8	40	55	-	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						2,221	-	22.2
Pasture,						26	-	.3
Residential,						377	-	3.7
Total area of town,						10,006	-	100.0



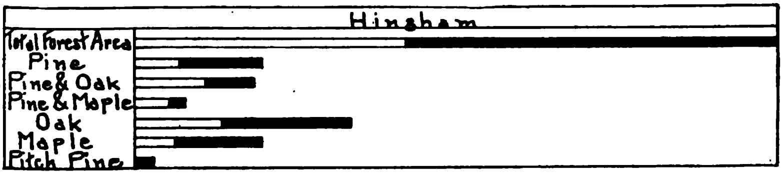
HANSON.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	69	176	195	365	63	868	12.3	-
Pine and oak,	-	19	208	309	391	927	13.1	-
Pine and maple,	-	19	208	-	-	227	3.2	-
Oak type,	-	290	788	1,430	800	3,308	47.0	-
Maple (swamp) type,	82	38	586	668	189	1,563	22.2	-
Pitch pine,	-	-	-	-	158	158	2.2	-
Total,	151	542	1,985	2,772	1,601	7,051	-	70
Per cent.,	2.1	7.7	28.2	39.3	22.7	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						1,655	-	16.3
Pasture,						422	-	4.2
Water,						479	-	4.6
Cranberry bog,						265	-	2.6
Marsh,						252	-	2.3
Total area of town,						10,124	-	100.0



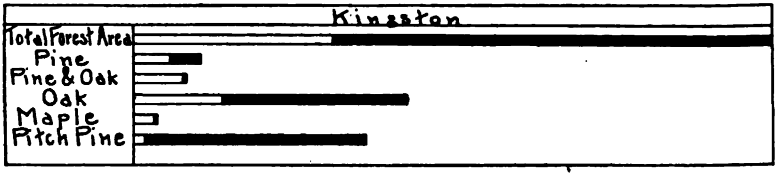
HINGHAM.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	190	318	310	554	-	1,372	19.2	-
Pine and oak,	18	123	617	541	-	1,299	18.1	-
Pine and maple,	49	80	257	154	-	540	7.5	-
Oak type,	209	263	445	1,473	-	2,390	33.4	-
Maple (swamp) type,	-	116	331	938	-	1,385	19.3	-
Pitch pine,	-	-	-	178	-	178	2.5	-
Total,	466	900	1,960	3,838	-	7,164	-	49.6
Per cent.,	6.5	12.6	27.4	53.5	-	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						3,243	-	22.4
Pasture,						2,421	-	16.8
Residential,						1,416	-	9.8
Water,						161	-	1.1
Marsh,						49	-	.3
Total area of town,						14,454	-	100.0



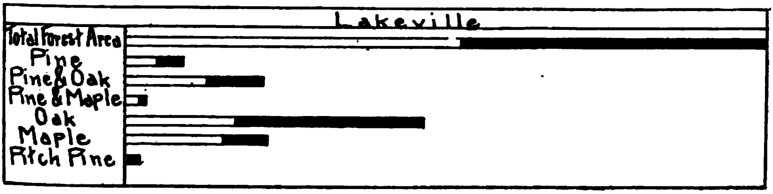
KINGSTON.

	Approximate Size Classes.					Total.	Per Cent.	
	1.	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	270	235	165	78	139	887	10.2	-
Pine and oak,	96	314	270	-	44	724	8.3	-
Oak type,	148	61	1,019	853	1,602	3,683	42.3	-
Maple (swamp) type,	-	131	78	-	70	279	3.2	-
Pitch pine,	113	-	627	183	2,213	3,136	36.0	-
Total,	627	741	2,159	1,114	4,068	8,709	-	71.5
Per cent.,	7.2	8.5	24.8	12.8	46.7	-	100.0	-
Non-forest Types.								
Tillage and hay,						2,107	-	17.3
Pasture,						97	-	.8
Residential,						780	-	6.4
Water,						341	-	2.8
Cranberry bog,						146	-	1.2
Total area of town,						12,180	-	100.0



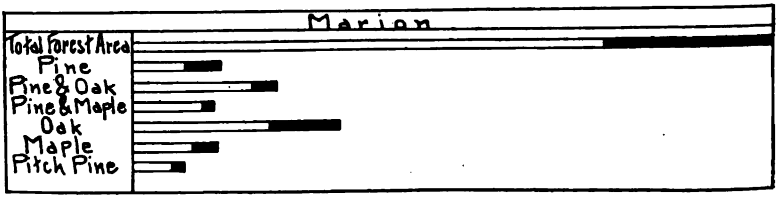
LAKEVILLE.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine, ...	134	652	284	200	-	1,270	7.6	-
Pine and oak, . . .	351	819	919	718	551	3,358	20.1	-
Pine and maple, . .	117	167	100	33	33	450	2.7	-
Oak type, ...	635	752	1,570	1,704	3,074	7,735	46.3	-
Maple (swamp) type, .	234	635	1,672	535	551	3,627	21.7	-
Pitch pine, ...	-	33	84	150	-	267	1.6	-
Total, ...	1,471	3,058	4,629	3,340	4,209	16,707	-	72.2
Per cent., ...	8.8	18.3	27.7	20	25.2	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay, ...						3,286	-	14.2
Pasture, ...						1,157	-	5.0
Residential, ...						370	-	1.6
Water, ...						1,134	-	4.9
Cranberry bog, ...						417	-	1.8
Marsh, ...						69	-	.3
Total area of town, ...						23,140	-	100.0



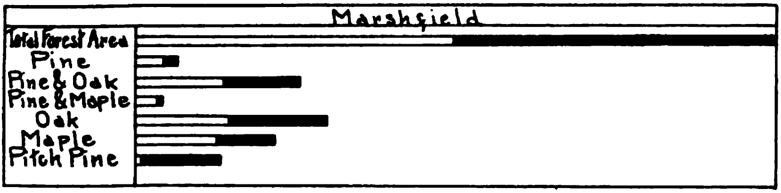
MARION.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	371	185	282	62	21	921	13.4	-
Pine and oak,	791	282	185	247	27	1,532	22.3	-
Pine and maple,	502	117	130	27	-	776	11.3	-
Oak type,	185	825	453	453	295	2,211	32.2	-
Maple (swamp) type,	82	151	419	137	110	899	13.1	-
Pitch pine,	89	337	103	-	-	529	7.7	-
Total,	2,020	1,897	1,572	926	453	6,868	-	75
Per cent.,	29.4	27.6	22.9	13.5	6.6	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						336	-	3.7
Pasture,						117	-	1.3
Residential,						618	-	6.8
Water,						268	-	2.9
Cranberry bog,						206	-	2.2
Marsh,						744	-	8.1
Total area of town,						9,157	-	100.0



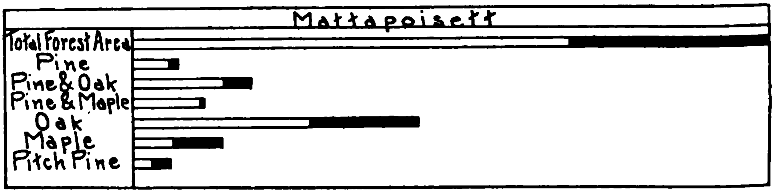
MARSHFIELD.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine, ...	135	242	72	81	45	575	6.4	-
Pine and oak, . . .	207	207	817	673	386	2,290	25.5	-
Pine and maple, . .	-	81	242	36	18	377	4.2	-
Oak type, ...	54	242	1,015	835	512	2,658	29.6	-
Maple (swamp) type, .	-	-	1,131	422	368	1,921	21.4	-
Pitch pine, . . .	-	45	494	269	350	1,158	12.9	-
Total, ...	396	817	3,771	2,316	1,679	8,979	-	49.2
Per cent., . . .	4.4	9.1	42	25.8	18.7	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay, ...						3,358	-	18.4
Pasture, ...						839	-	4.6
Residential, ...						986	-	5.4
Water, ...						292	-	1.6
Cranberry bog, ...						91	-	.5
Marsh, ...						3,705	-	20.3
Total area of town, ...						18,250	-	100.0



MATTAPOISETT.

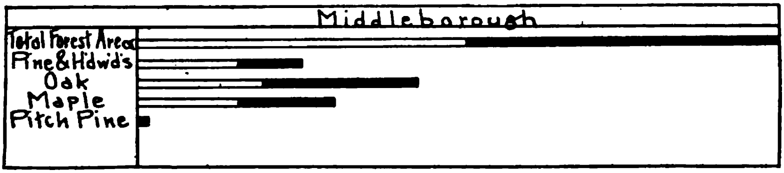
	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	334	147	41	-	49	571	7.0	-
Pine and oak,	580	326	237	98	245	1,486	18.3	-
Pine and maple,	530	237	106	33	-	906	11.2	-
Oak type,	440	1,011	799	587	750	3,587	44.3	-
Maple (swamp) type,	114	261	147	212	375	1,109	13.7	-
Pitch pine,	179	73	98	57	41	448	5.5	-
Total,	2,177	2,055	1,428	987	1,460	8,107	-	72.5
Per cent.,	26.9	25.3	17.6	12.2	18	-	100.0	-
Non-forest Types.								
Tillage and hay,						1,400	-	12.5
Pasture,						403	-	3.6
Residential,						373	-	3.3
Water,						136	-	1.2
Cranberry bog,						124	-	1.1
Marsh,						646	-	5.8
Total area of town,						11,189	-	100.0



MIDDLEBOROUGH.

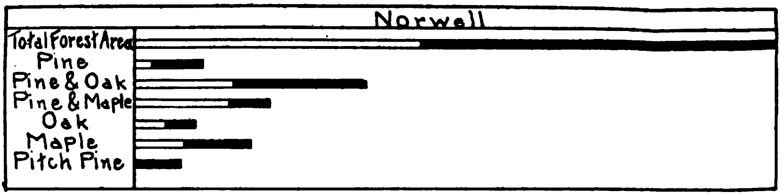
	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine, ...	1,365	1,197	2,943	3,499	–[1]	9,004	25.4	-
Pine and oak, . . .								
Pine and maple, . .								
Oak type, ...	679	1,332	4,969	8,347	–[1]	15,327	43.3	-
Maple (swamp) type, .	130	1,951	3,444	5,195	–[1]	10,720	30.3	-
Pitch pine, ...	10	108	79	145	–[1]	342	1.0	-
Total, ...	2,184	4,588	11,435	17,186	-	35,393	-	75.8
Per cent., ...	6.2	13	32.3	48.5	-	-	100.0	-
Non-forest Types.								
Tillage and hay, . . .						8,187	-	17.5
Pasture, ...						1,770	-	3.8
Residential, ...						785	-	1.7
Water, ...						511	-	1.1
Marsh, ...						44	-	.1
Total area of town, . . .						46,690	-	100.0

[1] Size classes 4 and 5 have been combined.



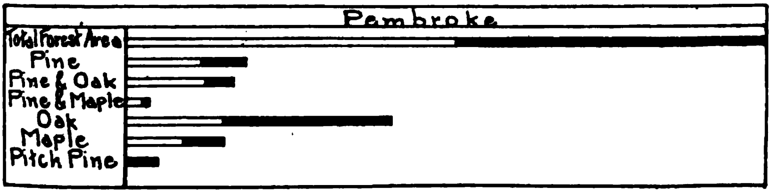
NORWELL.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	89	160	594	217	32	1,092	10.4	-
Pine and oak,	141	467	971	1,457	697	3,733	35.7	-
Pine and maple,	77	550	901	556	102	2,186	20.9	-
Oak type,	77	134	294	262	217	984	9.4	-
Maple (swamp) type,	26	326	435	658	300	1,745	16.6	-
Pitch pine,	-	-	300	192	243	735	7.0	-
Total,	410	1,637	3,495	3,342	1,591	10,475	-	76.7
Per cent.,	3.9	15.6	33.4	31.9	15.2	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						2,443	-	17.9
Pasture,						211	-	1.5
Residential,						89	-	.7
Water,						51	-	.4
Cranberry bog,						13	-	.1
Marsh,						371	-	2.7
Total area of town,						13,653	-	100.0



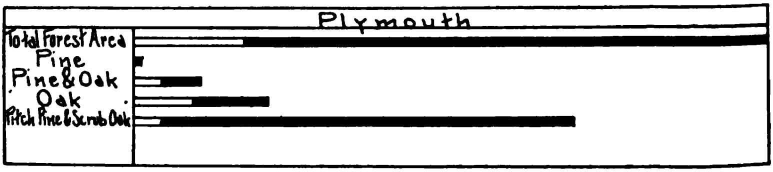
PEMBROKE.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	408	870	507	22	242	2,049	18.6	-
Pine and oak,	231	397	705	132	353	1,818	16.5	-
Pine and maple,	-	220	66	-	88	374	3.4	-
Oak type,	55	474	1,113	1,322	1,619	4,583	41.6	-
Maple (swamp) type,	33	297	650	595	77	1,652	15.0	-
Pitch pine,	-	-	66	-	474	540	4.9	-
Total,	727	2,258	3,107	2,071	2,853	11,016	-	74.0
Per cent.,	6.6	20.5	28.2	18.8	25.9	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						2,026	-	13.6
Pasture,						417	-	2.8
Residential,						74	-	.5
Water,						789	-	5.3
Cranberry bog,						342	-	2.3
Marsh,						223	-	1.5
Total area of town,						14,887	-	100.0



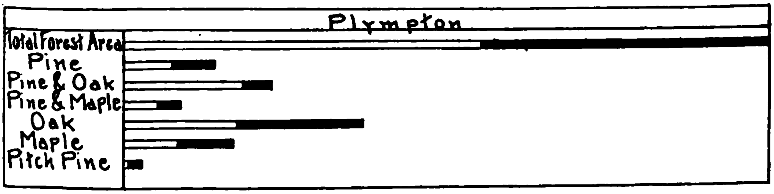
PLYMOUTH.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	163	54	218	54	-	489	.9	-
Pine and oak,	436	381	1,526	981	2,070	5,394	9.9	-
Oak type,	272	1,362	3,269	2,397	3,978	11,278	20.7	-
Pitch pine and scrub oak,	708	1,417	3,433	4,413	27,353	37,324	68.5	-
Total,	1,579	3,214	8,446	7,845	33,401	54,485	-	82.5
Per cent.,	2.9	5.9	15.5	14.4	61.3	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						5,020	-	7.6
Pasture,						330	-	.5
Residential,						1,783	-	2.7
Water,						3,500	-	5.3
Cranberry bog,						726	-	1.1
Marsh,						198	-	.3
Total area of town,						66,042	-	100.0



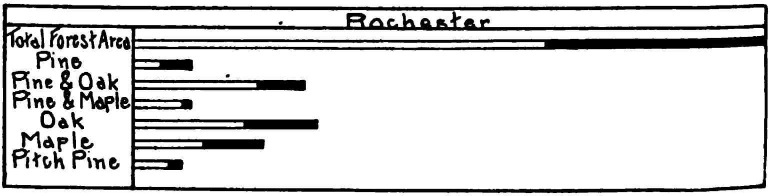
PLYMPTON.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	240	278	308	75	113	1,014	13.5	-
Pine and oak,	353	330	667	225	120	1,695	22.6	-
Pine and maple,	75	120	173	158	105	631	8.4	-
Oak type,	83	188	1,019	743	728	2,761	36.8	-
Maple (swamp) type,	-	60	532	458	188	1,238	16.5	-
Pitch pine,	30	23	30	-	83	166	2.2	-
Total,	781	999	2,729	1,659	1,337	7,505	-	77.2
Per cent.,	10.4	13.3	36.4	22.1	17.8	-	100.0	-
Non-forest Types.								
Tillage and hay,						1,486	-	15.3
Pasture,						331	-	3.4
Water,						39	-	.4
Cranberry bog,						185	-	1.9
Marsh,						175	-	1.8
Total area of town,						9,721	-	100.0



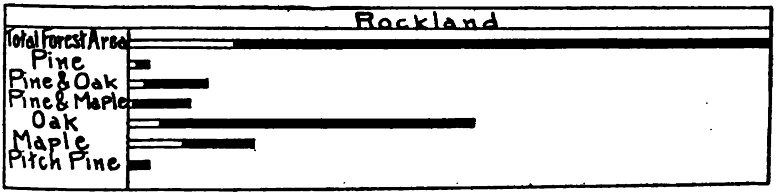
ROCHESTER.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	338	338	596	113	48	1,433	8.9	-
Pine and oak,	934	918	1,255	386	741	4,234	26.3	-
Pine and maple,	580	370	306	145	-	1,401	8.7	-
Oak type,	1,240	547	998	612	1,208	4,605	28.6	-
Maple (swamp) type,	193	757	773	885	628	3,236	20.1	-
Pitch pine,	419	467	64	177	64	1,191	7.4	-
Total,	3,704	3,397	3,992	2,318	2,689	16,100	-	69.8
Per cent.,	23	21.1	24.8	14.4	16.7	-	100.0	-
Non-forest Types.								
Tillage and hay,						3,206	-	13.9
Pasture,						1,107	-	4.8
Residential,						323	-	1.4
Water,						1,338	-	5.8
Cranberry bog,						784	-	3.4
Marsh,						208	-	.9
Total area of town,						23,066	-	100.0



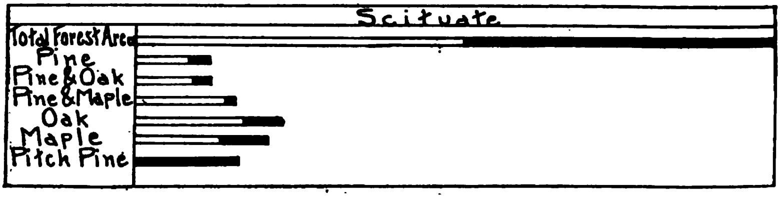
ROCKLAND.

	Approximate Size Classes.					Total.	Per Cent.	
	1	2	3	4	5		Forest.	Town.
Forest Types.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	20	18	10	72	-	120	2.8	-
Pine and oak,	-	-	96	126	295	517	12.0	-
Pine and maple,	-	-	30	193	181	404	9.4	-
Oak type,	30	24	138	819	1,300	2,311	53.9	-
Maple (swamp) type,	24	48	277	439	30	818	19.1	-
Pitch pine,	-	-	-	102	18	120	2.8	-
Total,	74	90	551	1,751	1,824	4,290	-	66.3
Per cent.,	1.7	2.1	12.8	40.8	42.6	-	100.0	-
Non-forest Types.								
Tillage and hay,						1,007	-	15.6
Pasture,						223	-	3.4
Residential,						861	-	13.3
Water,						24	-	.4
Marsh,						66	-	1.0
Total area of town,						6,471	-	100.0



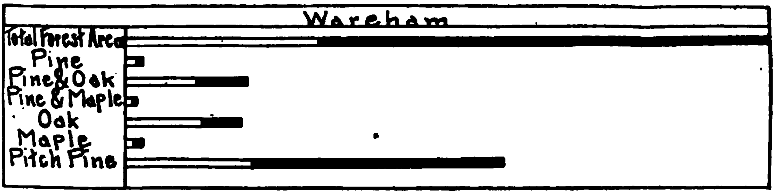
SCITUATE.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine, ...	11	74	319	160	17	581	11.7	-
Pine and oak, . . .	80	86	274	154	-	594	11.9	-
Pine and maple, . .	40	268	382	103	-	793	15.9	-
Oak type, ...	239	245	348	143	182	1,157	23.3	-
Maple (swamp) type, .	80	137	450	239	125	1,031	20.8	-
Pitch pine, . . .	-	-	200	194	422	816	16.4	-
Total, ...	450	810	1,973	993	746	4,972	-	45.5
Per cent., . . .	9.1	16.3	39.7	19.9	15	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay, ...						2,291	-	21.0
Pasture, ...						325	-	3.0
Residential, ...						1,277	-	11.7
Water, ...						296	-	2.7
Marsh, ...						1,761	-	16.1
Total area of town, ...						10,922	-	100.0



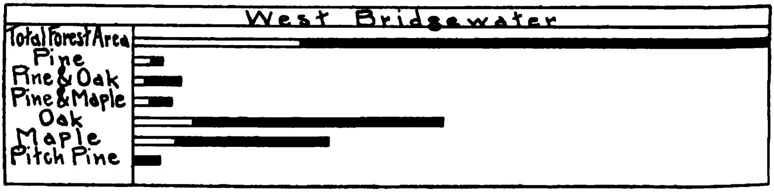
WAREHAM.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	49	196	49	-	82	376	2.3	-
Pine and oak,	443	376	950	327	917	3,013	18.4	-
Pine and maple,	82	16	49	-	49	196	1.2	-
Oak type,	312	655	917	327	605	2,816	17.2	-
Maple (swamp) type,	16	49	65	147	82	359	2.2	-
Pitch pine,	278	950	1,981	1,425	4,961	9,595	58.7	-
Total,	1,180	2,242	4,011	2,226	6,696	16,355	-	67.2
Per cent.,	7.2	13.7	24.5	13.6	41	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						2,750	-	11.3
Pasture,						535	-	2.2
Residential,						535	-	2.2
Water,						1,947	-	8.0
Cranberry bog,						1,047	-	4.3
Marsh,						1,169	-	4.8
Total area of town,						24,338	-	100.0



WEST BRIDGEWATER.

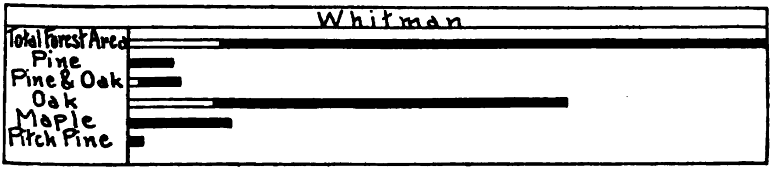
	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	58	105	41	17	23	244	4.4	-
Pine and oak,	12	-	76	174	145	407	7.3	-
Pine and maple,	-	29	105	168	23	325	5.8	-
Oak type,	110	116	401	657	1,418	2,702	48.2	-
Maple (swamp) type,	-	52	407	999	250	1,708	30.5	-
Pitch pine,	-	-	-	-	216	216	3.8	-
Total,	180	302	1,030	2,015	2,075	5,602	-	55.6
Per cent.,	3.2	5.4	18.4	36	37	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						3,081	-	30.6
Pasture,						767	-	7.6
Residential,						535	-	5.3
Water,						52	-	.5
Marsh,						46	-	.4
Total area of town,						10,063	-	100.0



WHITMAN.

	APPROXIMATE SIZE CLASSES.					Total.	PER CENT.	
	1	2	3	4	5		Forest.	Town.
FOREST TYPES.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.		
Pine,	-	-	122	-	-	122	6.4	-
Pine and oak,	-	-	30	61	55	146	7.6	-
Oak type,[1]	-	24	225	565	502	1,316	68.6	-
Maple (swamp type),	-	-	-	213	85	298	15.5	-
Pitch pine,	-	-	-	37	-	37	1.9	-
Total,	-	24	377	876	642	1,919	-	42.9
Per cent.,	-	1.3	19.6	45.6	33.5	-	100.0	-
NON-FOREST TYPES.								
Tillage and hay,						952	-	21.3
Pasture,						475	-	10.6
Residential,						1,070	-	23.9
Marsh,						57	-	1.3
Total area of town,						4,473	-	100.0

[1] Considerable maple in mixture in medium and small sizes.



List of Sawmill Operators and Box Shops in Plymouth County, classified and indexed under Names of Towns.

Town.	Name.	Class.[1]	Buys.	Product.	Stock.
Abington,	E. J. Rourke,	4	– – –	– – –	Pine and oak.
Bridgewater,	F. C. Gammons,	2	Logs,	Box boards,	White pine.
Bridgewater,	B. F. Ellis,	3	Logs,	Boards and custom,	Pine and oak.
Brockton,	Mackie Brothers,	2	Boards,	Boxes,	White and pitch pine.
Brockton,	E. L. Bonney,	2	Boards and logs,	Boxes,	White pine.
Brockton,	Brockton Wood Working Company.	3	– – –	– – –	– – –
Brockton,	George E. Keith,	2	Logs and boards,	Boxes and shooks,	White pine.
Duxbury,	Lot Phillips,	–	– – –	–[2] – –	– – –
Carver,	T. M. Cole,	3	Logs,	Box boards and boxes,	White pine.
East Bridgewater,	Arthur Churchill,	–	– – –	Portable mill,	– – –
Halifax,	B. B. Waterman,	3	Logs,	Cordwood and charcoal,	Maple.
Halifax,	Austin Thompson,	4	Logs,	Box boards,	White pine.
Halifax,	J. B. Thompson,	3	Logs,	Box boards,	White pine.
Hanson,	G. L. Haywood,	4	Logs,	Box boards,	White pine.
Hanson (South),	John Foster Company,	1	Logs,	Boxes and shooks,	Pine, poplar, hemlock, spruce.
Hanover (North),	Wallis Hackett,	4	Logs,	Box boards and custom,	White pine.
Hanover (West),	Lot Phillips & Co.,	1	Logs and boards,	Boxes,	White pine.

Hanover,	National Fireworks Company,	-	- - -	- - -	- - -
Hingham,	Geo. Haywood,	4	Logs,	Custom,	- - -
Kingston,	F. G. Brackett,	3	Logs,	Box boards, planks, long boards,	White pine and oak.
Lakeville,	Betty's Neck Company,	3	Logs,	Boxes and barrels,	White pine and poplar.
Marion,	W. H. Ryder,	4	Logs,	- - -	- - -
Marion,	W. E. Sparrow,	4	Logs,	Box boards,	White pine.
Mattapoisett,	E. C. Stetson,	4	Logs,	Boards and shingles,	White pine and cedar.
Mattapoisett,	Dennis Mahoney,	2	Logs,	Box boards,	White pine and oak.
Middleborough,	Z. P. Cushman,	3	Logs,	Box boards and planks,	White pine and oak.
Middleborough,	L. O. Atwood,	1	Logs,	Boxes and shooks,	White pine.
Middleborough,	James Thomas,	3	Logs,	Box boards, mallet heads, rolls,	White pine and hornbeam.
Marshfield,	Chandler Mill,	3	Logs,	Box boards and lobster pots,	White pine and oak.
Norwell,	Arnold Beech Mill,	3	Logs,	Boards and custom,	White pine.
Norwell,	Dwelley Mill,	3	Logs,	Boards,	White pine.
Norwell,	Joseph Merritt,	4	Logs,	Box boards,	White pine.
Norwell,	C. H. Hackett,	4	Logs,	Box boards,	White pine.
Pembroke,	Lot Phillips branch,	-	- - -	- - -	- - -
Pembroke,	Horatio Chandler,	3	Logs,	Box boards,	White pine.
Pembroke,	Gilbert West,	1	Logs and boards,	Boxes,	Pine, oak, maple, chestnut, poplar.
Plymouth,	C. E. Taylor,	3	Sawed boards,	Boxes,	White pine.

---

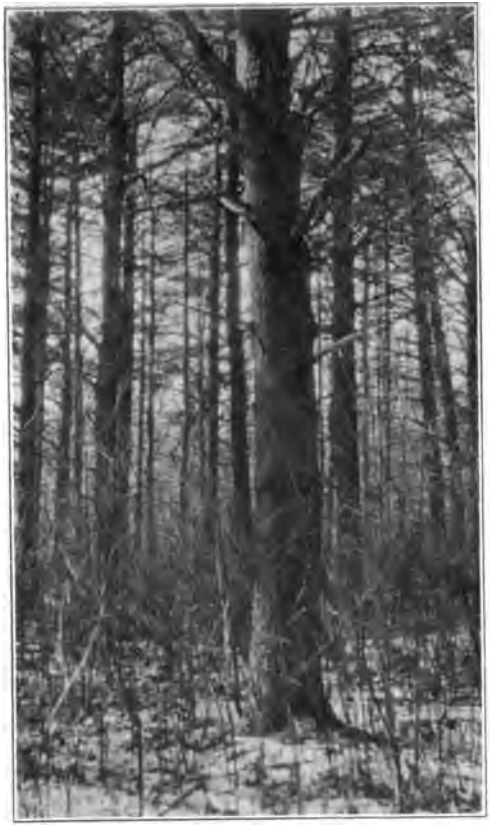
[1] Class 4 saws less than 100,000 board feet per year; class 3 saws from 100,000 to 500,000 board feet per year; class 2 saws from 500,000 to 2,000,000 board feet per year; class 1 saws more than 2,000,000 board feet per year.

[2] See West Hanover.

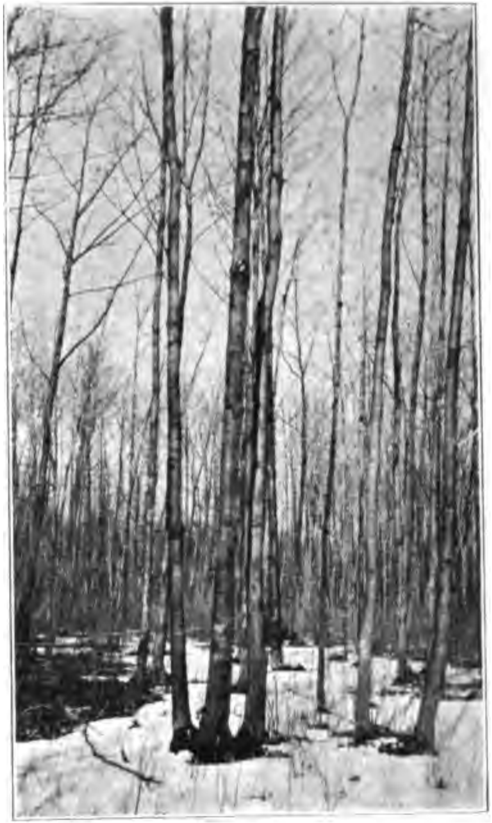
LIST OF SAWMILL OPERATORS AND BOX SHOPS IN PLYMOUTH COUNTY, CLASSIFIED AND INDEXED UNDER NAMES OF TOWNS — *Concluded.*

TOWN.	Name.	Class.[1]	Buys.	Product.	Stock.
Plympton,	Dennett Brothers,	3	Logs,	Box boards,	White pine.
Plympton,	Wm. Perkins,	3	Logs,	Boxes and barrels,	White pine and cedar.
Plympton,	Washburn & Soule,	3	Logs,	Boxes, shooks, barrels,	White pine and cedar.
Rochester,	Rounseville Brothers,	2	Logs,	Boxes, building lumber,	White pine and oak.
Rochester,	James Hartley,	3	Logs and boards,	Box boards and planks,	White pine and oak.
Rochester,	Ira Fuller,	3	- - -	Portable mill,	- - -
Scituate,	C. H. Walker,	4	Logs,	Lobster pots and toys,	White pine and oak.
Wareham,	Taylor & Holmes,	3	- - -	Barrels,	White pine.
Wareham,	Geo. Morse,	2	Logs,	Box boards and cooperage,	White and pitch pine.
Whitman,	Atwood Brothers,	1	Logs,	Boxes,	White pine.

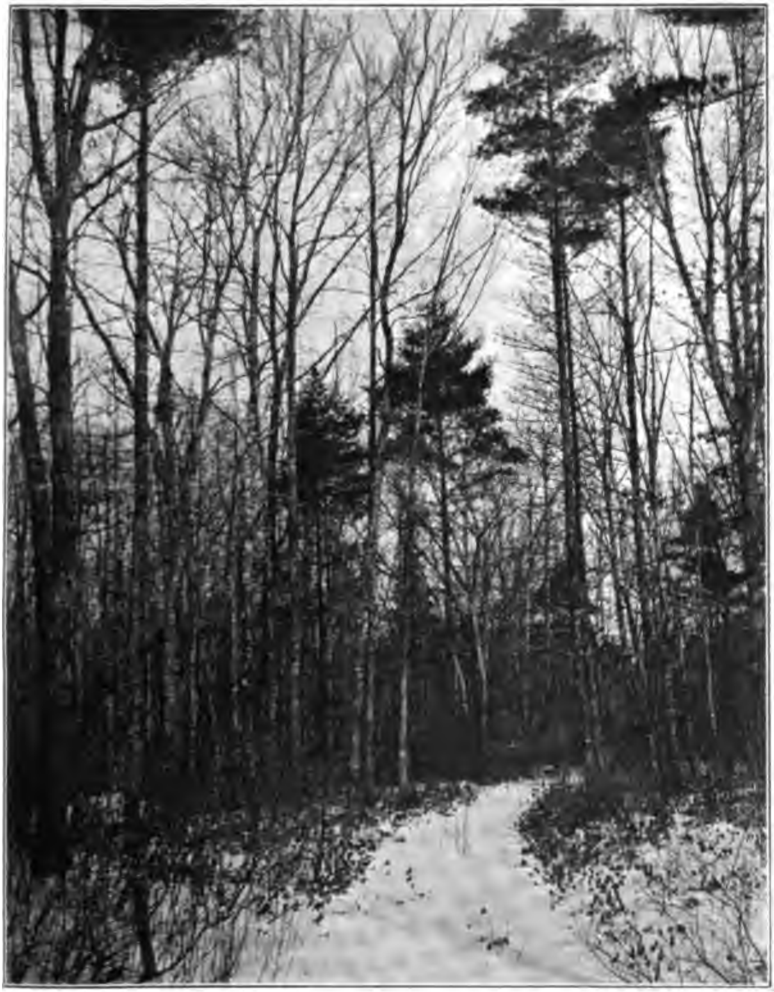
[1] Class 4 saws less than 100,000 board feet per year; class 3 saws from 100,000 to 500,000 board feet per year; class 2 saws from 500,000 to 2,000,000 board feet per year; class 1 saws more than 2,000,000 board feet per year.



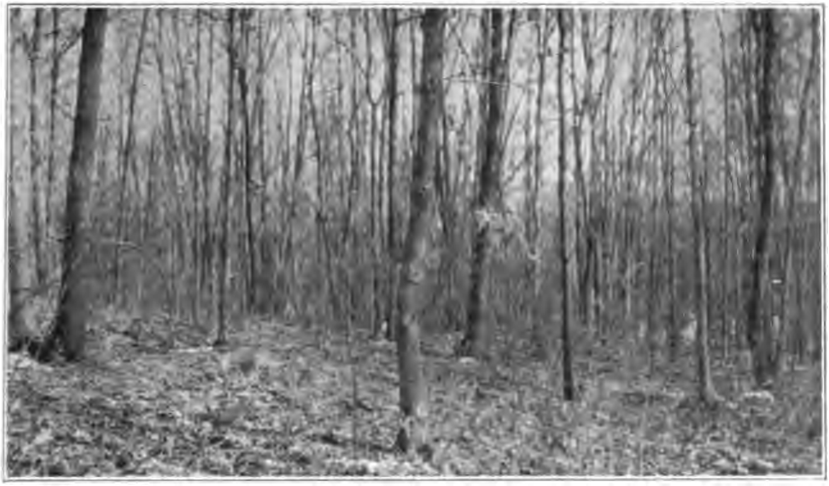
White pine type. Diameter, 10 inches or larger; heights,



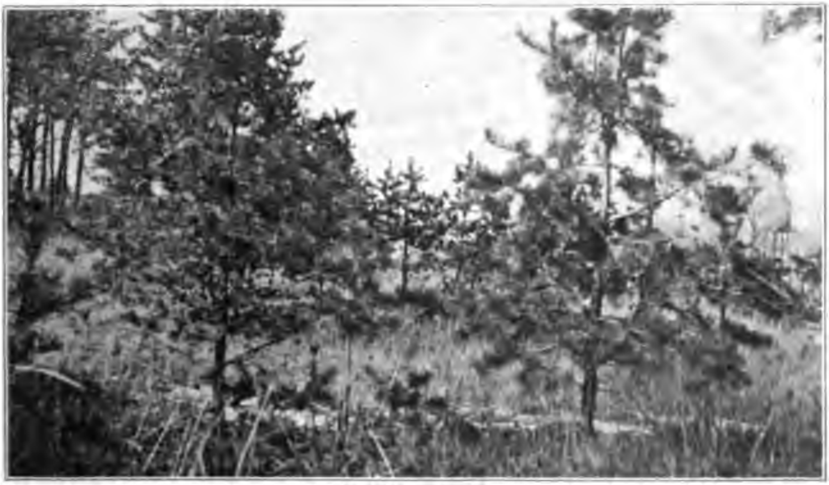
Maple (swamp) type. Diameter, about 5 inches; heights,



Pine, maple and oak. Diameters, 6 to 10 inches; heights, 50 to 60 feet. (Pine and hardwoods type, Class 2.)



Oak type. Diameter, about 5 inches; heights, 40 to 50 feet. (Class 3.)



Pitch pine type. (Classes 4 and 5.)

THE UTILIZATION OF FOREST PRODUCTS IN MASSACHUSETTS

AS AFFECTED BY THE WAR

By PAUL D. KNEELAND, M.F.
Assistant Forester

Under the Direction of
F. W. RANE, B.Agr., M.S.
Massachusetts State Forester

BOSTON
WRIGHT & POTTER PRINTING COMPANY, STATE PRINTERS
32 DERNE STREET
1918

PUBLICATION OF THIS DOCUMENT
APPROVED BY THE
SUPERVISOR OF ADMINISTRATION.

THE UTILIZATION OF FOREST PRODUCTS IN MASSACHUSETTS AS AFFECTED BY THE WAR.

Introduction.

The war in which we are now engaged has wrought great changes in the field of forest utilization. Many of these changes have been kaleidoscopic in their action, and they are still going on. What was true a year ago, perhaps, does not hold true to-day, and very likely will be still different a year from now. This bulletin is written from a popular rather than a scientific point of view, in order that the woodland owner may know some of the conditions which now prevail, and be able to take advantage of them. There is bound to be a reaction after the war, but there is little probability that things will go back to their former status.

Of all our natural resources perhaps the forests were the last to be called upon to help win the war. The other two great sources of raw material — the field crops and the mineral reserves — felt the stimulation of war prices long before this country entered the conflict. It was not until we were in it, and the great programs for ships, airplanes, cantonments, etc., were under way, that the lumber business became a great and necessary factor.

Massachusetts forests have not been able to help in a large way as have those of many of her sister States. Of airplane spruce and ship timbers we have but little. However, our forests are doing their bit, and all that our State can furnish is needed.

White Pine.

White pine is our most important species. Its chief market has always been for box boards. The war has brought about a great increase in this demand. Most of our munitions have to be boxed or crated for shipment, thus necessitating a tremendous quantity of wooden boxing material. The freight situation has until recently practically closed all outside sources of supply. The high price of paper has lessened the substitution of paper for wooden boxes. Under this great demand and lack of competition the price of box boards has nearly doubled. Production has greatly increased, but the demand still remains. Round edge box lumber has been sold as high as $40 a thousand feet delivered, and square edge, $5 or $6 higher. At this time a slight reaction is on, and it is the general opinion that prices will not go much higher. Some box shops favorably situated to a steady local supply of lumber are buying box boards at considerably less than the prices quoted. Some are paying less than $30 per M and claim to be getting all they need at that price. As always happens when prices rise rapidly, the increase is not the same in all sections. The seller should seek more distant markets if the local buyers are unwilling to pay the market price. The thicknesses most in demand have been 1 inch and 2⅛ inches, which make the heavier material for export shipments.

While the price of box boards has soared, the demand for the better grades, such as are used in sash and blind manufacture, construction, etc., has remained stationary, or almost ceased. The very highest grades which are used in making patterns, or directly by the army or navy, have commanded high prices. The intermediate grades are not being sorted, but are turned into box boards with the rest. There is practically no market for them at present except as box boards. The 2⅛-inch pine for match blocks is in good demand, and also the pine for toys, pails, etc.

A slight demand for white pine piling has arisen, due to the difficulty in getting spruce.

Hemlock and Spruce.

Hemlock is an important species in Massachusetts, while spruce is not found except in a limited area. The usual way of utilizing these species was to cut them into square edge or small dimension material. The demand for this has greatly diminished, and the price has not risen in proportion to that of box boards. Both species can be sold as box lumber for about $2 to $3 under the price of pine, so that is the best way of utilization at present. There is a good market for both spruce and hemlock for pulp cut 4 feet long and peeled, but most of the pulp mills are in the north, and our local operators and labor are unaccustomed to that form of utilization, so little pulp is cut in Massachusetts.

Hemlock bark has again come into demand at about $15 a cord on the cars. At this price it certainly will pay to peel the larger hemlock.

Chestnut.

The market for chestnut is our most important consideration at this time. The chestnut blight has spread rapidly, and there seems to be no hope that it will cease as suddenly as it came. There is also no known practicable cure or preventive for it. Within a few years, or a decade at best, our second most important species will be gone. In the meantime we must have a market for it, or most of the dead material will be a total loss. Fortunately, there is at present a good sale for all chestnut large enough for lumber, although this market is different from that of several years ago. The prices have not gone up in proportion with the pine price. The present uses of chestnut may be classified as follows: —

1. *Poles, Posts, and Piling.* — There is practically no sale for posts, except local. The demand for poles is fair, but not as good as formerly. When the cantonments were in construction there was a very heavy demand. Since then, due to the policy of the telephone and light companies in doing as little new construction as possible, the demand has slackened, but there are bound to be a good many used for replacement and upkeep. The price of poles does not seem to have risen in proportion to the increase in lumber. The specifications and prices of the Western Electric Company, the largest single buyer of poles in New England, are appended herewith. They state that they will continue buying all the larger poles offered. Some chestnut piling has been bought lately by the railroads and also for fish weirs. That is a market worth looking into, as the sticks do not have to be peeled.

2. *Cross Ties.* — New prices and specifications have been

issued since the government took over the railroads. They are appended herewith. A maximum price has been fixed which applies to all lines in New England. Not all the roads are now paying the maximum price or buying all classes, but it is expected that before long they will. All ties must be sold to the road on whose lines they are delivered. They cannot be shipped from one road to another. It is intimated that the railroads will do the buying for the trolley lines. Hard times have hit the trolley lines, anyway. Many have been discontinued, and the rest are doing as little in the line of construction and repair as possible. Therefore the market for the small trolley ties seems to be poor. The new price for ties averages slightly higher than previously, but not in proportion to the increase in lumber. The price of the smaller ties is lower than it was previously on certain roads. The 6-inch tie with 5-inch face is no longer specified, and will not be taken except as a cull, price not known. The small tie is our mainstay from the point of view of utilization of our forests, and it is to be hoped that later on the Railroad Administration may rectify the matter of their price and size. Probably the reason for the low price is that the railroads want as few of the small ties as possible. Operators should take the hint and cut their production of small ties to a minimum. The smaller chestnut can be more profitably used as lumber, and at present prices of lumber the larger material also.

3. *Lumber.* — The chestnut lumber market is the promising feature of the whole situation. The almost universal disposition of chestnut lumber in Massachusetts before the war — that of sawing it 1½ inches round edge for the chair factories — has been somewhat modified. The chair factories are still buying and paying good prices, but are not buying in increased amounts. In fact, their demand has slightly decreased. Chestnut has come into demand for box boards as a substitute for pine. For this purpose, it is sawed mostly 1 inch with some ⅝ inch and 1½ inches thickness. The price has been from $2 to $5 per M less than the price for pine, while a little mixed with the pine has been accepted without price reduction. Not all box shops will buy chestnut, but an increasing number will. In this way it is possible to utilize trees which will make only

small ties, or which will be too small to make ties at all. Some operators have been cutting chestnut down to 4 inches, but that is not advisable if a sure market for the lumber is desirable, 6 inches being a safer minimum diameter.

There is a good demand for the better grades of chestnut squared up from the butt, and good second logs. This lumber is being sold in place of the southern chestnut, graded No. 1 and No. 2 common. In thicknesses of 1 inch, 1½ inches, 2 inches and thicker, 6 inches and up wide, it is commanding a price of from $40 to $55 per thousand feet delivered. Care should be taken, however, to saw this material full to thickness, so that it will dry to those sizes; also it must be stuck and dried properly. This material is used for coffins, finish, furniture, cabinet work, piano cases, construction, etc. Even higher prices might be realized if great care in sawing and grading is exercised. Wormy material cannot be sold in this class, nor can it be sold extensively for chair stock. Railroad ties and box boards are the best market for wormy chestnut. Some wormy lumber can be sold square edge, if it is sound, at a lesser price.

Some chestnut has been used for ship timbers, but it is doubtful whether that demand will continue.

Oak.

Oak is fast disappearing from the eastern section of the State, due to the gypsy moth. However, it is our most important hardwood tree, and in extensive demand at this time. The chief uses may be classified as follows: —

1. *Piling.* — White and red oak are in constant demand for piling. White oak is specified in some cases, but usually either may be used. The prices have ranged from 25 cents to $1 (for very large sticks) per running foot for the piles delivered. About all the larger piles must be from 7 to 8 inches diameter at the small end, and from 14 to 20 inches at the butt. Lengths run from 30 to 60 feet. All must be fairly straight and thoroughly sound. The chief difficulty with piling is in handling, as it requires special knowledge and equipment. It is not advisable to cut piles except on order, as they rapidly deteriorate.

Oak piles are easy to handle in connection with a chestnut pole operation.

2. *Cross Ties.* — All railroads now accept all the oak ties offered. White oak commands a higher price, and red oak a somewhat lower price, than does chestnut. The prices are not such as to make the manufacture of oak ties advisable except for knotty upper cuts and crooked, poorer grade logs.

3. *Car Stock.* — There is a great demand by the railroads for oak sawed into dimension stock and plank for car repairs. It cannot be sold except to the road on whose lines it is delivered. The price has recently been fixed at $40 on the cars for red oak, and $43 for white oak. This price is considerably below what the roads were paying before the price was fixed. Unless the price is increased, other classes of material offer a better market for oak. Before cutting car stock it is necessary to receive an order from some dealer or the purchasing agent of the railroad.

4. *Wagon and Ship Plank.* — This is the highest grade of oak produced. It should be cut only from the best butts and second cuts from large, sound trees. Thicknesses 2, 2½, 3 and 4 inches. All should be sawed a little over, to allow for drying, and in as long lengths as possible. Prices range from $50 to $75 per M sawed round edge. Some prices for exceptional width and quality have been up to $100 per M. For ship building, larger timbers, especially those with crooks and bends, are in demand. These pieces often run up to 32 feet in length, and are flatted on two sides. There does not seem to be any standard price, but these timbers are usually sold by the stick.

5. *Chairs and Furniture.* — There is a very good demand for round edge oak of fair quality, sawed 1⅛, 1⅜, 1⅝ and 2⅛ inches for the chair and furniture shops. Prices run from $35 to $60 delivered, depending on quality, etc. Most buyers like to get this material log run without the best butts being taken out. This is the surest and easiest market for oak lumber.

6. There are a number of other miscellaneous markets for native oak, as for finish, machinery, bridges, baskets, etc. It is advisable to handle and saw the oak carefully if the best prices are to be obtained.

Hardwood.

Hardwood is the term usually applied to beech, birch and maple lumber. They are often sold without any distinction between species, or may be sold separately. There has always been a wide, but somewhat specialized, difficult and low-priced market for these species. The war has resulted in higher prices and increased demand. It can now be said that it pays to saw all hardwood of good size and quality. Chairs and furniture still make the chief outlet, sawed 1⅛, 1⅜, 1⅝ and 2⅛ inches. Birch has always been in fine demand for bobbins, shuttles and spools. Hardwoods are used in all kinds of machinery specialties, tools, toys, pails, etc. The new market is for railroad ties. These ties will be shipped to roads having creosoting plants. It is doubtful whether the price is high enough to pay an operator to cut beech ties unless he has a short haul and low operating costs. The price for hardwood lumber ranges from $28 to $40 delivered. Square edge and especially selected lumber might easily bring a higher price. No poor grade hardwood should be sawed, but put into cordwood.

Ash.

Ash is being used in airplane manufacture. For that purpose only very select material is taken, and the price is high. For wagons, sporting goods, agricultural implements and baskets there is a strong demand. Two and one-eighth inches is the standard thickness of ash, with some 2½ and 3 inches. The basket makers use 1¼ and 1½ inches also. The market for 1-inch ash is difficult.

Miscellaneous.

Poplar can be sawed as box boards and peeled for pulp or used for baskets (sawed ½ inch). Basswood can be sold for box-boards or pulp also. It has a very good market sawed 2⅛ inches for certain special manufacturers. Butternut and black ash can be sold as box boards. Hickory is very difficult of sale here in Massachusetts. Tupelo (or "hornbeam") can be sold in the log for rolls. Elm can be sold for ship building and wagon manufacture chiefly. Cherry can be sold for chairs and furniture. There is a special war use for cherry, — airplane propellers, — but it takes a very high grade.

Cordwood.

Cordwood for fuel has been one of the great features of the past year. The price last February was as high in isolated instances as $12 to $13 a cord on the cars and $20 delivered. The price has now settled to about $8 to $10 a cord on the cars. It cannot go much lower than that with the present cost of labor and teams. We doubt very much whether there will be any such demand this winter as there was last, as there is much more wood cut. Very few of the woodland owners profited by those high prices last year. It went largely to the dealers and speculators. The market for chestnut wood is rather difficult. A limited amount can be sold from $1 to $2 under the price of hardwood. There is always a good demand for slabs and edgings for kindling wood. Owners should keep on cutting cordwood, but without the expectation of enormous profits. There is bound to be a good demand, and also a reaction after the present fuel crisis.

Labor.

The most difficult problem to-day for those wishing to produce lumber or wood is that of labor. It has steadily increased in cost, decreased in efficiency, and is now hard to find at any price. The cost of operating is surely double what it was three years ago, and the difficulties of operating are increased many fold. This must be borne in mind when the present high prices of products are considered. Labor is bound to get more scarce as the war continues.

Stumpage Value.

The value of lumber and wood stumpage of all kinds has unquestionably gone up in the last year. Pine lots have been sold as high as $20 per M on the stump, and cordwood as high as $4 per cord. Those prices are undoubtedly war prices, and will not last for long. However, pine stumpage is worth from $10 to $15 now, according to quality and location, for lots within a two-trip haul of the railroad, and will probably never go far back from those figures. More distant lots, or very small or difficult lots, are worth less than that. Chestnut, hemlock and spruce are worth from $2 to $3 less. Hardwood has about half of the value of pine. Oak and ash are worth more than pine.

Government Control.

The chief energies of the nation are to-day centered on the war. The government is slowly but surely heading all our forces so that they may directly contribute to the winning of the war. The lumber business must be prepared to do its share, if not voluntarily, then perhaps under government control. The recent embargo on the shipment on the railroads of all lumber and forest products is probably a step toward that end. It is now impossible to ship forest material (cordwood not included) on the cars without a permit, except to the government or to the railroads. At this writing the cause and effect of this embargo are not known. It may last for the duration of the war. Its effect will undoubtedly be to check the production of lumber for unnecessary uses, its shipment long distances, and the hoarding of lumber supplies. It will certainly stimulate the production of lumber for direct government use, and may result in lower prices and lessened production. The lumber producer must be prepared for anything. It is no time for speculation. Forest products are vital at this time, and the government will do nothing to hinder their production, but it will probably guide this production along necessary channels.

The Need of Forestry at the Present Time.

There never was a time when the need of forestry, of forest conservation, was greater than it is at present. We are undoubtedly, due to the impetus of the war, overcutting our forests, especially our pine forests here in Massachusetts; that is, we are cutting the lumber faster than it is growing. That means a shortage of lumber later, and the loss of wood-using industries which will go where they can get the raw material. Furthermore, we are cutting destructively, with no idea of the future of the land. After the war, when we settle down to pay the bills, we shall see more clearly the need of thrift and conservation. More than half of our area is fit only for forests. Woods and lumber work is the mainstay of most of our rural communities, especially in the winter. We must use our forests carefully and wisely if we are to keep our population. Cordwood can be cut with an eye to future production, saving the species and trees that will make lumber. Lumber can be cut with an eye to the future, saving the reproduction, being careful with fires and replanting. A representative of the British Board of Agriculture said in a recent speech that if France and Italy had not practiced forestry and conservation, Britain would now be beaten. Our forest resources are more vital in an emergency than they are in the times of peace. We must look out for them carefully.

Help by the State Forester.

The State Forestry Department maintains as one part of its service a branch of operation and utilization. This branch is prepared to give advice, information and active aid to the forest owners and operators of the State. This bulletin does not contain specific names of industries or persons buying or selling forest products or woodlands. Conditions are changing so rapdily that it was deemed impossible to print such information at this time. A large quantity of such information is on file, however, at the State Forester's office, and will be given on application. Specific questions or problems will be gladly answered. Estimates and valuations of woodlands will be made on application. The only cost is the payment of traveling expenses. Lumbering and cordwood operations will be carried on in co-operation with the owner, if the work be done along forestry lines, and the owner can furnish all the capital necessary for the operation.

Chestnut Poles.

SPECIFICATIONS.

All poles shall be of sound, live, white chestnut, squared at both ends, straight, well-proportioned from butt to top, peeled and knots neatly trimmed to the surface of the pole.

The dimensions of the poles shall be according to the following table: —

The "butt" circumference, 6 feet from the butt.

The "top" measurements, the circumference at the top of the pole.

Poles not conforming to specification will be rejected or cut back to the next shorter length.

Trees to make the following size poles should be 5 inches larger overbark 6 feet from the butt: —

Dimensions of Poles by Inches (Circumference).

Length of Pole (Feet).	Class "A."		Length of Pole (Feet).	Class "B."		Length of Pole (Feet).	Class "C."	
	Top (Inches).	Six Feet from Butt (Inches).		Top (Inches).	Six Feet from Butt (Inches).		Top (Inches).	Six Feet from Butt (Inches).
25	24	36	25	22	33	20	20	30
30	24	40	30	22	36	25	20	30
35	24	43	35	22	40	-	-	-
40	24	45	40	22	43	-	-	-
45	24	48	45	22	47	-	-	-
50	24	51	50	22	50	-	-	-
55	22	54	55	22	53	-	-	-
60	22	57	60	22	56	-	-	-

Prices F. O. B. Point of Shipment.

	Each.
20 feet, Class C,	$2 00
25 feet, Class C,	2 25
22 feet, Class A,	2 75
25 feet, Class B,	2 75
25 feet, Class A,	3 75
30 feet, Class B,	3 75
30 feet, Class A,	5 00
35 feet, Class B,	6 00
35 feet, Class A,	7 50

United States Railroad Administration.

SPECIFICATIONS FOR CROSS TIES.

GRADE No.	Squared.	Flatted.
1,	- -	6 x 6 inches.
2.	6 inches thick, 7-inch face,	6 inches thick, 7-inch face.
3,	6 inches thick, 8-inch face,	6 inches thick, 8-inch face. 7 inches thick, 7-inch face.
4,	7 inches thick, 8-inch face,	7 inches thick, 8-inch face.
5,	7 inches thick, 9-inch face,	7 inches thick, 9-inch face.

Maximum Prices.

	Grade 1.	Grade 2.	Grade 3.	Grade 4.	Grade 5.
White oak,	$0 60	$0 70	$0 95	$1 20	$1 25
Chestnut,	50	70	90	1 10	1 10
Red oaks,	40	50	75	1 00	1 10
Beech, birches, hard maples,	40	50	75	90	95

Ties 8 feet are 6 per cent. less in price than above.

Quality. — All ties shall be free from any defects that may impair their strength or durability as cross ties, such as decay, splits, shakes or large or numerous holes or knots.

Manufacture. — Ties ought to be made from trees which have been felled not longer than one month.

All ties shall be straight, well-manufactured, cut square at the ends, have top and bottom parallel, and have bark entirely removed.

Dimensions. — All ties shall be 8 feet 6 inches long.

All ties shall measure both sections between 20 and 40 inches from the middle of the tie; and dimensions given are minimum.

Ties over 1 inch more in thickness, over 3 inches more in width, or over 2 inches more in length will be degraded or rejected.

The top of the tie is the plane farthest from the pith of the tree, whether or not the pith is present in the tie.

Delivery. — All ties ought to be delivered to a railroad within one month after being made.

Boston Transcript
324 Washington Street, Boston, Mass.
WEDNESDAY, DECEMBER 26, 1917

PLENTY OF FUEL WOOD

State Forester Impatient Over Delay in Utilizing the Forest Product When Coal Is at a Premium

State Forester Frank W. Rane contends that, with proper handling of wood fuel, using the material that is readily available, and which should be harvested from the forests, Massachusetts could shake off her dependency upon coal.

"Wood is the natural fuel of Massachusetts," he says. "Why should we disregard so valuable a birthright? It is not only our patriotic duty to use fire wood for fuel at this time in order to give way for the coal so much needed in our industries and hard to get, but even of greater fundamental importance to us as an economic people it is unutterably and absolutely wrong for us not to utilize the millions of cords of wood that is actually standing on the hills and mountain sides and in our valleys, in fact, actually going to waste everywhere due to our lethargy and unscientific awakening.

"Why should people be freezing in our cities and towns this winter while wood is actually rotting and wasting all over our State within their very grasp?

"Why should we wish for coal to keep us warm when the wood that should be cut for the better improvement of our woodlands and forests, if nothing else, should be available? There are thousands of cords of fallen and standing dead and dry wood waiting for harvesting in Massachusetts this very minute, which, if not utilized, will become a forest-fire menace to our State later on, probably costing us no one knows how much in conflagrations, not taking into account the utter desolation and waste they leave behind them.

"With our present reservoir of natural fuel going to waste while we are spending our energies and bewailing the fact that we are going to freeze this winter, it is nothing short of lack of foresight and dependence upon the great Provider who has placed at our bidding plenty in store for our use. If we cannot see it and will not use it, simply because we would rather be warmed by some other substance, then let us freeze. This, in substance, is nothing short of our real attitude at the present hour.

"The State Forester's Department has been active in advocating and aiding our people in forest utilization for years, and at least 30,000 cords have been made available outside of the ordinary channels through this work, but this is not enough. We need a wideopen campaign of greater accomplishments . While the State offers assistance in the way of advice through the State Forester's Department, this does not pay the laboring man who will chop wood.

"If we can get the national or State fuel administrator, or some other authority, to determine upon what the minimum price will be for standard grades of cordwood at shipping points on the cars, and then secondly, organize some method of financing wood cutting operations, retaining a lien upon the product until it is sold, there is no question but that something of real accomplishment could be done.

"Why not go farther and commandeer that wood shall be used more generally if it is for the best interest and good of our section of the country. This is not a time for guesswork, but for the cold realities of a real situation that should be dealt with at once. It is ridiculous to be compelled to pay $17 or more for cordwood in one locality, and half of that amount in another. Many look upon wood as a luxury, when it should be as natural a home product and in as common use as any of our agricultural crops. It is an actual fact that farmers and those living in the country have even this year laid in their coal supply for fuel at distances of fifteen miles from market when wood could have been had almost for the chopping on their own lands. .Why transport coal from Pennsylvania and other coal fields and block traffic and use freight cars for accomplishing what, nothing but a great economic waste.

"We have talked conservation for years, but talk is cheap. Not many years ago our railroads used cordwood in their engines here in Massachusetts, and if the truth were actually known, even steam could be generated in many boilers in manufacturing plants scattered throughout New England, that could be generated from wood.

"It may entail many simple though easily wrought out ideas to show how wood can be used in furnaces and stoves as well as hearth fires. The writer has given a great deal of attention to this subject and even discussed it months ago with our authorities, but even yet, he feels we are slumbering while we should be wideawake on the whole proposition."

SHALL

With
of foreign
such pests
creases, t
These nu
They hav
cost of fi
consumer

Gran
some esti
very con
costs over
these are
bark dise
that have
conservati
crops is
of five;

This

Federal Horticultural Board puts on a
Government and growers begin to spend
pest. Many of the civilized countries of
Hungary, Greece and Germany, have rec
and have legislated against the importatic

Those who are engaged in the im
the status quo should continue. It is c
insect pests they will eventually reach he
diseases of the world will be found in e
Therefore, it is argued that the sooner
shall have the parasites or other enemies
and balances in nature. The weakness o
has already been done by imported pests

It is stated, and with some justificat
or as cheaply here as abroad. It must
the control of pests which is borne by al
easier for the importer to take his prof
himself. On the other hand, in nearly ev
here which were formerly imported, it ha
thrives well here, it cannot be propagate
and agriculturists agree that we can prc
haste to obtain forest evergreen seedlings
shouldn't our propagators be given some
they find what they can do in this count
would soon find that they could grow the
profitable business to importers but this
may be compared to a large business corp
would an efficient business corporation con
if by so doing, it was losing many times t

Everyone must admit that we have
can we afford to continue such importatio
we bring in an insect or disease which des
problem does not hinge so much on whet
PLANTS SHALL BE BROUGHT IN?
the introduction of useful foreign plants
insects and diseases. The question then be
THE INSECTS AND DISEASES?

Granted there is no absolute guaran
diseases on our shores, surely the chances
carriers are eliminated. Natural carriers
prohibit the importation of all such ma
here which are grown abroad. We should
the U. S. Department of Agriculture sho
pose. It should be required to hold these
it was certain that they were free from
among the growers who would soon prop
business would be improved, in this cou
plants. We would keep the money at ho
the purchaser would not have to pay any
be free from pests.

quarantine. The stable is locked after the horse is stolen, and the
money fighting the pest. The quarantine should arrive before the
the world among which are France, Holland, Switzerland, Austria-
ognized the danger that comes from the introduction of plant pests
ns of plants. The United States should recognize this necessity.
portation of plant materials naturally present arguments why
laimed that whatever course is taken to prevent the importation of
re; that it is only a matter of time until all of the insects and plant
very section where the environment is favorable for their existence.
ve can bring about this condition in this country the sooner we
of all these pests which will tend to establish a system of checks
f such an argument is clear when we consider how much damage
and how much more they will do before the parasites come.

ion, that one cannot grow certain plants used in the trade as well
be remembered however, that the cost of inspection of plants and
l the people is not added to the cost of such plants. Of course, it is
it as a middleman on plants grown abroad than to grow them
ery instance where an earnest effort has been made to grow plants
s been a success. It is hard to convince the layman that if a plant
ed advantageously here. In fact many of our leading horticulturists
pagate any plant in this country that can be grown here. Our
resulted in the introduction of the dread pine blister rust. Why
protection by a prohibition of the entry of plant materials until
ry? If such a prohibition were established, many of our importers
plants they now import. The importation of plants may be a
is a matter which affects the country as a whole. The nation
oration in which the importation of plants is a side line. How long
tinue to operate a subsidiary concern, however profitable in itself,
hat profit on its main operations?

gained much through the importation of plants from abroad, but
under the present methods? If by importing one valuable plant,
troys an equally valuable native plant, what have we gained? The
her we should continue to bring in plants but HOW SUCH
This is the crux of the whole matter. We are all benefited by
and we are all injured by the importation of plant destroying
comes HOW ARE WE TO GET THE PLANTS WITHOUT

tee against the accidental landing of some of these insects or
of their coming can be reduced to a minimum if their *natural*
are plant materials, therefore, to prevent the importation of pests,
terials. There are many varieties of plants of commercial value
still be able to secure enough of these plants for propagation and
ld be authoried to import them in small quantities for that pur-
plants, and to fumigate and inspect the same until such time as
all insects and diseases. These plants could then be distributed
gate them for the market in any quantity desired. The nursery
try, and there would be more labor for those skilled in growing
e that now goes abroad for plants, and we believe in the long run
igher price for his plants than they now cost him and they would

WOOD FUEL

A BULLETIN

To Stimulate the Production and Use of Wood as
Fuel for Patriotic and Economic Reasons
as a War Measure

CONTENTS

Page

Wood Fuel 3

Reasons for Stimulating Wood Production 3

Wood versus Coal 4

Qualities of Woods for Fuel . 5

Page

How to Cut 6

Transportation 8

What to Cut 9

Aid by State Forestry Department 10

Conclusions 10

By PAUL D. KNEELAND, M.F.
Assistant Forester in Charge Utilization and Operations

Under the Direction of
F. W. RANE, B.AGR., M.S.
Massachusetts State Forester

Publication of this Document
approved by the
Supervisor of Administration.

WOOD FUEL.

Last spring, in a statement issued by the State Forestry Department advising woodland owners to cut cordwood, it was said that the price of wood was mounting so rapidly that soon cordwood might be as valuable property as a gold mine. However picturesquely worded, that statement has been amply borne out by the facts. Many who have cut wood this past year have doubled or even trebled their investment. In many localities prices have approached the coal strike level. But now the production of cordwood has gone beyond the matter of profit; it has become a problem of patriotic endeavor and grim war necessity. There is still the appeal to the purse, but that has become secondary to the need for fuel of all kinds, which can be met in a considerable measure only by substituting the product of the New England woodlot for the coal from the Pennsylvania mines.

Reasons for Stimulating Wood Production.

We have had our flour shortage and our sugar shortage, and, unless all signs fail, we shall have a fuel shortage — if not this winter, then the winter following. This will be felt more in the smaller communities than in the cities, unless cordwood is made to take the place of coal to a large degree. There is no excuse in a man's shivering for lack of fuel if trees and forests grow all about him; at least, that is what those who have the allotting of coal are very likely to say when it comes to a pinch. So it seems that it will be up to the rural communities, not only to supply their own fuel, but also to help in supplying the larger towns and cities.

Wood is a more primitive fuel than is coal. In the cities its use in normal times, except for kindling, has been confined to the two extremes, — to the well-to-do, who use it for the cheer of the open hearth, and to the poor, who cannot afford a continuous fire. In the country wood has been largely supplanted by coal for heating purposes, even in the kitchen range. Wood is used only where its lower cost and greater convenience as a summer fuel are factors. However, in these times we shall have to get back to essentials, — wood is better than no fuel at all. We have sufficient quantities of wood close at hand. Coal is not close at hand, and we may not be able to get it. It behooves the prudent man to stock up with wood, and that quickly. It is for the patriotic as well as foresighted man to cut, not only enough wood for himself, but for his neighbor who cannot cut it himself.

Wood versus Coal.

Wood is inferior to coal in convenience of handling, in lasting qualities while burning and in fuel value. Roughly speaking, 1 ton of coal has as much fuel value or heat units as 2 tons of dry wood. A cord of good dry hard wood, such as oak, hickory, hard maple or beech, weighs about 2 tons, and so equals a ton of good hard coal (such as we seldom see nowadays, by the way). But wood has many advantages over coal, which it might be well to point out at this time, to show that its wider use will not be altogether a hardship.

1. It is less wasteful. It consumes completely without waste. It does not burn when not needed.

2. It is cleaner. There are very few ashes and practically no dust, dirt or gas. There are no cinders to sift and dispose of.

3. It is hotter. One can get a hot fire much more quickly than with coal.

4. It is often more convenient. For cooking purposes wood gives a quick hot fire, being next to gas in that respect. In the warm weather it is not necessary to heat up the kitchen, as does a coal fire. For the rapid heating of a room with fireplace or stove, or for "taking the chill off the house" with the furnace, wood comes in very handy.

5. Under many conditions it is a cheaper fuel. The farmer or owner of a wooded estate who can cut wood with his own or hired labor gets fuel at only a fraction of the cost of coal. In most rural districts, and in communities at a distance from the railroad, wood at present prices is cheaper than coal. Even in the larger cities, where, due to high distribution expense, a cord

of wood costs more than a ton of coal, wood if used properly can save more than its cost in coal. In extreme weather by burning wood in fireplaces or stoves, as an auxiliary, it is not necessary to drive the furnace so hard, and thus the excessive use of coal which that entails is avoided. In the fall and spring the house can be kept comfortable by wood alone, burned at morning and night to keep the chill and dampness away. Wood burned part of the time is cheaper than coal burned all the time. Where a continual fire is not needed a great saving can be made by burning wood instead of coal.

Qualities of Woods for Fuel.

Woods vary greatly in their characteristics and value as fuel. In general, the fuel value or caloric content varies directly with the specific gravity. In other words, the heavier the wood the more heat it contains. Hickory, white oak, sugar maple, beech, red oak, ash, yellow and black birch, red maple, white birch, chestnut, gray birch, poplar and willow are the chief hardwoods of this region, and have weights and fuel value about in the order named. Larch, hemlock, spruce, pine and cedar are the chief softwoods, and are chiefly valuable for kindling, since their fuel value is so low, being only about half of that of hickory. The fuel value also varies with the dryness of the wood. It takes considerable heat to evaporate the moisture from green wood, and so leaves less of the heat available for use. Wood dries very rapidly when first cut, and so wood, even three or four months dry, is considerably better than green wood. However, for keeping qualities on the fire green wood is better. It is possible to run the furnace all night with green or partly green wood, and impossible with dry, except very big hunks. Green gray birch and poplar are better than dry. When dry these woods burn almost as rapidly as pine kindling, and so are not very valuable for fuel purposes. When green, however, they last longer on the fire, and so are comparable with the other hardwoods. The fuel value also varies with the size of the stick, as there is more heat in cleft or split wood than in round sticks. This is partly because the split wood dries more rapidly and so contains less moisture, and partly because there is less heat in the bark and sapwood than in the heartwood. Small round wood has a larger proportion of the bark and sap than the large cleft pieces.

Wood varies in other qualities besides fuel value. Chestnut and hemlock are very snappy, and so are unsuited for extensive fireplace use. Black oak is so slow drying that it never gets really dry, but always hisses and smoulders on the fire. The birches and red maple are free burning and hot, and so make a very cheerful fire in the hearth. Hickory and the oaks ignite slowly, but when thoroughly ignited give a hot, enduring fire. Apple and cherry wood make a beautiful flame. Red cedar gives a pleasant odor.

How to cut.

The methods of producing wood fuel have not advanced considerably since the earliest times. The experienced wood chopper with his axe, cutting by the cord, is still the cheapest way of producing cordwood under most conditions. The matter with him is that he is too few. If we have to depend on experienced cord labor in the present emergency we shall not have nearly enough wood to meet the demand. In many sections wood chopping is a lost art. The lumber and pulp industries, as well as the general manufacturing industries, with their high wages and steady work, have recruited heavily from the already thinned ranks of the woodchoppers. The present price for cutting by the cord varies all the way from $1.75 to $3 per cord, depending on the chance, the character of the wood, the need of the owner and the bargaining ability of the chopper. The wages may go even higher. The man hiring wood chopped by the cord has several other things to think of than the exact price he pays. Often a camp has to be provided for the choppers, and even their families, to live in. That adds to the cost. Also wood chopping is a trade requiring skill, and as in many other skilled trades there are many tricks to catch the unwary. Wood is often piled on stumps, cross piled, etc., so as to make less than a cord look like a cord. It is often cut short or not properly split. There is a natural shrinkage in wood when it dries, and this with the improper piling usually makes a 5 to 10 per cent. loss when the wood is sold. The loss to inexperienced operators has often exceeded that.

Wood that is cut by the cord is usually piled in the woods in

4-foot lengths where cut, and when dry hauled out by teams. Before being used it must be sawed up into shorter lengths, and usually split further. This is done either by hand or machine. The wood-sawing machine has come into very general use. Dealers have one in their yards, and in almost every community there is a portable machine with a rotary saw and gasoline power which will cut wood for from 75 cents to $1.50 a cord, $1 being the usual price. Such a machine now costs from $250 to $500. It will cut from 15 to 20 cords of wood, in 4-foot lengths, into stove wood per day. There are also splitting machines which work efficiently on short lengths.

Many farmers nowadays are cutting their wood in convenient lengths longer than 4 feet, often called sled lengths. These sticks they haul direct to their yards and have cut into stove lengths, usually by machine. This is an improvement over the old method, especially as it allows the use of day labor in cutting instead of cord labor. This is the method we recommend to all farmers and others who cut near-by wood for their own use, or to dealers who supply a local trade. The cost of the method is well within reasonable limits.

Wood in short lengths is much more difficult and expensive to handle dry, and ship any distance, than is wood in 4-foot lengths. With proper conveying machinery it probably can be done economically, but to our knowledge it has never been done yet. Practically all wood which is shipped to the cities or to the wood-using industrial plants comes in 4-foot lengths. The problem that now confronts us, therefore, is to devise methods of economically shipping for considerable distances wood in short lengths, or producing economically, by machinery, wood in 4-foot lengths. We are convinced that machinery in wood production is the only answer in the present emergency. Day labor, largely unskilled in woods work, must be used in wood production. To learn to use an axe as do the French-Canadian wood choppers is impossible except after years of practice. The use of a saw in felling a tree is not so difficult to learn, and by cutting up the tree by machinery we can greatly heighten our production with the labor available. An unskilled woodchopper cannot produce a cord of wood a day, cutting it up in 4-foot lengths in the woods. Probably one-half cord would be an average. Therefore that method of producing wood is impossible except in the case of the most urgent necessity, or of small operations, or to keep permanent labor busy during the slack times. It is not a commercial proposition, even with the present high price of wood, with unskilled labor costing about $3 a day.

The shipping of short wood may be successfully done by motor trucks going direct to the consumer from the wood pile. Probably 15 to 20 miles is the limit on that, however. The State Forestry Department is now devising a machine by which it is expected to produce 4-foot wood at about $3.50 per cord, all yarded out and piled ready for drying and shipment. Others are probably working on the same problem. If this proves successful, similar machines scattered throughout New England can greatly increase the wood production.

Transportation.

There is less difficulty in hiring teams than in hiring woodchoppers this winter. In the spring and summer, when the teams are busy on the farms and roads, it is apt to be hard to get them. The standard price for teams is now, in the slack time, about $6 per day. Around the cities prices range to $7 or $8. Teams should make two trips up to 4 or 4½ miles, and one trip per day up to 9 or 10 miles. On hauls of less than 2 miles three or four trips per day should be possible, especially if extra help in loading and unloading is provided. It is wise to have several teams hauling at once in order to help each other over the hills, and to make help in handling the wood more profitable. The best practice is to use several teams, and have at least one extra man to help load in the woods, and perhaps another at the car or unloading point. A good team will haul a cord and a half of heavy wood, as hickory or oak, except where there are bad hills. Of lighter wood, as chestnut, two cords or more can be hauled. In the winter, on sleds, up to 50 per cent. more can be hauled than the above figures indicate. For motor trucks the wood must be yarded out to a good road at a cost of from 75 cents to $1.25 a cord. For this reason, motor trucks do not pay except on long hauls, — 6 or 7 miles or more. A 6-ton truck will carry four cords of wood. They can be hired for from $20 to $30 a day, which includes the driver. Extra help must be provided for loading and unloading. Seventy-five miles a day is about the maximum for a heavy truck, but that cannot be attained without quick loading and unloading. Light and fast trucks, which carry a cord or less, can also be used in hauling wood, but care should be exercised not to overload them. However, the heavy trucks will be found more efficient.

What to Cut.

Softwoods, trees of large enough size for lumber, or healthy stands of high future lumber value should not be cut for fuel at this time. Softwood has low fuel value, and should be saved for lumber, pulp, etc., Enough kindling can be obtained from lumbering and sawmill waste and inferior trees. Of course if there are only a few trees of log size in a stand to be cut, it might be advisable to put them into wood with the rest. Large growths should be saved for lumber as the main product, not for wood. Young stands which contain considerable ash, basswood, hard maple, poplar and oak (outside the gypsy moth area) should not be put into wood. The ideal sizes of trees for cordwood are from 4 to 8 inches in diameter. Smaller than that the wood is inferior; larger than that it is usually better suited for logs and is difficult to split. Certain species are best suited for wood and will never make good lumber. Chief among these are the red or swamp maple, gray birch and the oaks in the Cape Cod region and on poor soil in other localities. In many places smaller stands of beech, birch and maple are now of more value as wood than they ever will be for lumber. Chestnut stands of less than tie or pole size can now be advantageously put into wood, as on account of the blight they will probably never mature, and the wood can be disposed of in the present emergency, a thing which may be impossible later.

The present fuel shortage opens an opportunity to the owner of woodland which has never before been presented. He can now thin out inferior trees and poor species from a mixed stand, and so practice forestry and improve his property at a profit. It is hard to get cordwood choppers, paid by the cord, to cut in thinnings. Now, when day labor must be employed anyway, it is just about as cheap to make a thinning. The present demand for wood will make practically any kind of cordwood salable. In fact, dead wood, as oak, killed by the moths, blighted chestnut and gray birch are rather at an advantage because they can be sold and burned immediately, while most green wood must be seasoned somewhat before it is fit to use. It is strongly urged on owners of woodlands not to spoil the future production of their land by reckless cutting, even in the present emergency. Clear cutting should be done only in maple swamps, in gray birch or infested oak or chestnut areas. In other types of growth, where it is possible to leave something of future lumber value, the best trees should not be cut.

Aid by State Forestry Department.

This department is anxious to aid in the wood fuel situation in all possible ways. We have cut and sold over 30,000 cords of wood within the last four years, and maybe our experiences will be of value at this time. We are willing to help both in the production and the distribution. Any owner can call on us for an inspection of a woodlot where cutting is proposed, and we will give advice, give estimates, mark trees for cutting, etc., without charge. We will help, if possible, in procuring labor to carry on the work, devising special machinery, or getting teams and motor trucks. We will help in selling and disposing of the wood also if desired. This department will also co-operate directly with the owner in cutting wood. If the owner will provide the capital for carrying on the work we will look out for the operation and sell the wood for him without charge (except traveling expenses in some cases). The State Forestry Department is here to help all citizens of the Commonwealth at this time, and we hope they will freely call on us.

Conclusions.

1. A greatly increased production of cordwood for fuel is necessary at this time as a war measure.

2. Wood, although not as good a fuel as coal, is a very satisfactory substitute, and there is a sufficient supply close at hand, if it is cut.

3. Regular cordwood choppers are hard to find at present, but

their loss can be made up in a large measure by wood-sawing machines.

4. Now is an especially good time to cut and dispose of the dead and inferior trees and to make improvement thinnings.

5. The State Forestry Department should be called upon for help by all interested in producing or obtaining fuel.

OFFICIAL REGISTER
OF
HARVARD UNIVERSITY

VOLUME VII JULY 16, 1910 NUMBER 28

Walter Mulford

DIVISION OF FORESTRY

1910–11

Published by Harvard University
CAMBRIDGE, MASS.

OFFICIAL REGISTER OF HARVARD UNIVERSITY

[*Entered, March 24, 1905, at Boston, Mass., as second-class matter,
under Act of Congress of July 16, 1894.*]

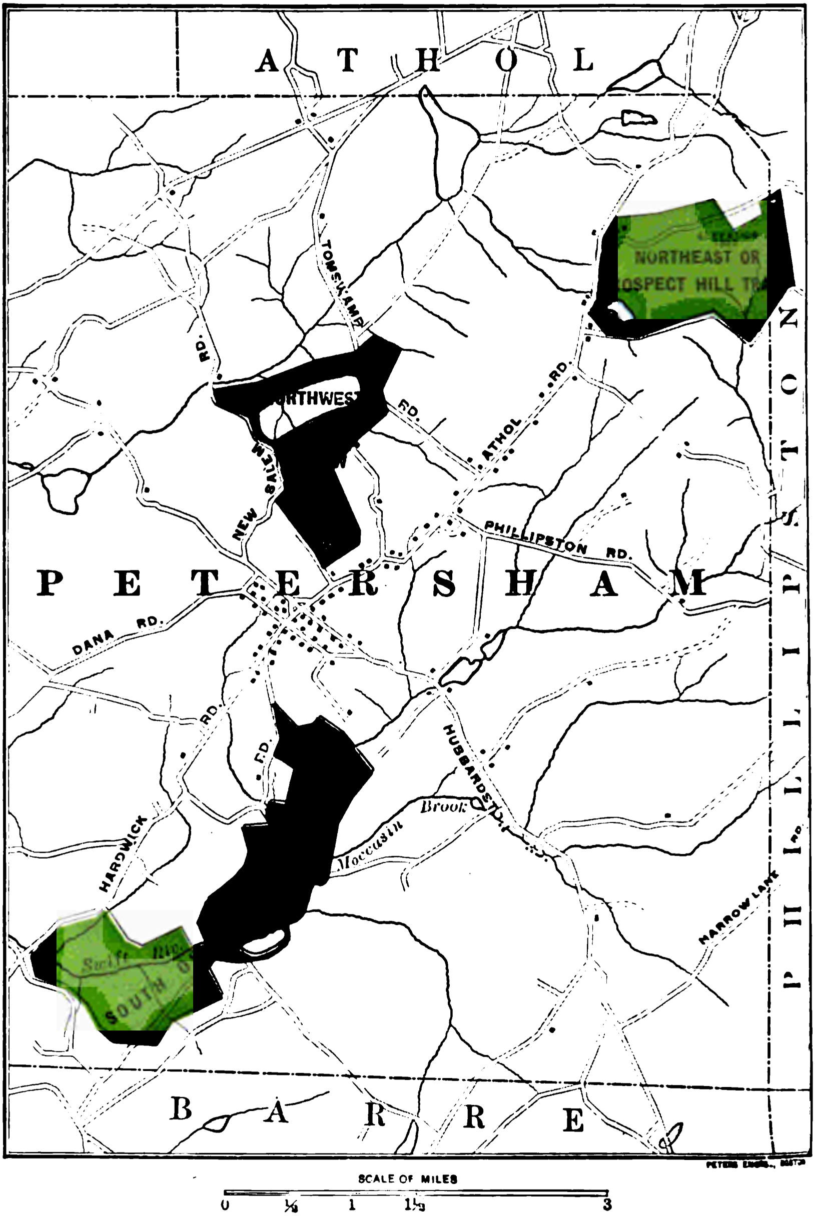
Issued at Cambridge Station, Boston, Mass., twice a month from October to March inclusive, six times a month from April to September inclusive.

These publications include:—

The Annual Reports of the President and of the Treasurer.

The Annual University Catalogue.

The Annual Catalogues of the College and the several Professional Schools of the University; the Announcements of the several Departments; etc., etc.



HARVARD UNIVERSITY: HARVARD FOREST, PETERSHAM, MASS., 2,000 ACRES

INSTRUCTORS

RICHARD THORNTON FISHER, A.B., M.F., *Assistant Professor of Forestry*, and *Chairman of the Division of Forestry.*

EDWARD CHARLES JEFFREY, Ph.D., *Professor of Plant Morphology.*

JOHN GEORGE JACK, *Assistant Professor of Dendrology.*

CHARLES THOMAS BRUES, S.M., *Instructor in Economic Entomology.*

IRVING WIDMER BAILEY, A.B., M.F., *Instructor in Forestry.*

———, *Instructor in Forestry.*

FACULTY OF ARTS AND SCIENCES

DIVISION OF FORESTRY

GENERAL STATEMENT

The professional course in Forestry offered by Harvard University is organized with a view to meeting, and, in a measure, anticipating, developments in the field for employment. Forestry is still a new and not yet clearly established profession, and its progress depends very largely on the skill with which its pioneers meet the problems now confronting the chief forest owners of the country. At present the main employers of foresters are the National Government and the States. Private and corporate owners, although they take on each year an increasing number of trained men, employ so far relatively few. Yet it is likely that as forestry becomes recognized, and its practice financially justifiable, private work will offer an even more attractive opening than public. Whatever the field, success involves not only a thorough technical training, but also a practical insight into methods and conditions actually obtaining in the forest industries. Thus a forester who is to do the best constructive work, and contribute to the making of his own opportunities, should have had substantial experience in logging and the lumber business, at least for some one region, and if possible also in the application of intensive forestry to a given forest.

The arrangement of the course, which covers two years, is designed to give the student the maximum of field work and experience in connection with the management of the Harvard Forest at Petersham. The academic year is divided into three terms, — a spring and an autumn term devoted to work in the woods, and a winter term devoted to lectures, laboratory, herbarium and arboretum work in Cambridge. The annual operations on the Harvard Forest, in which the students participate, include for the first-year men in October and November elementary work in dendrology, silviculture, and forest measurements, and in April and May, the construction of a working plan, forest planting and nursery work, practice in marking for cuttings, and work in the saw-mill. During the winter term, extending from December 1 to April 1, and while the students are in Cambridge, the course includes wood structure, dendrology, protection, the practice of forestry in the forest regions of the United States, and the theory of forest management. In the autumn of the second year, at Petersham, the class carries out the logging operations planned in their work of the preceding spring, taking part in the regular woods work of felling, sawing, yarding, etc. In addition each man is assigned a topic connected with the application of forest management upon which he prepares a thesis. Upon the return to Cambridge, and in continuation of the elementary practical work carried out in the Harvard Forest, the class begins the study of general lumbering in its engineering, executive, and business aspects. This course consists of lectures, reading, and the careful study of a large, typical logging operation. For this purpose three weeks are spent during January in making a report upon the working and organization of a single company. This assignment follows introductory lectures on the broad principles governing methods and costs of lumbering and precedes subsequent work on lumbering in the different forest regions of the United States. In addition to lumbering, the winter term of the second year includes courses in forest products, forest entomology, and forest history and administration. The final spring term is devoted to an extended field problem involving the examination and valuation of a large tract of wild land. This problem covers methods of woods surveying, the estimation of standing timber, and the study of the feasible methods of logging and management for the tract in question. Through this correlation of work in the two years' course a student is enabled to get an increasingly practical and clear knowledge of the underlying organization of typical forest industries. He is in close touch with the progress of the annual operations on the Harvard Forest, and his technical instruction is developed with constant reference to its use in a representative case.

ADMISSION

Membership in the School of Applied Science is open to men who are graduates of a college or scientific school in good standing. Other men of suitable age and attainments may also be admitted by the Administrative Board of the School by special vote in each case, but such admission does not imply admission to candidacy for a degree.

Students of special advanced subjects will be admitted to any courses for which their previous training fits them upon obtaining the approval of the Division.

PLAN OF STUDY FOR THE DEGREE OF MASTER IN FORESTRY

The preparation which is necessary and which must ordinarily be completed before entering upon the technical studies for the degree of Master in Forestry includes a satisfactory knowledge of Botany and Geology; elementary Physics, Chemistry, Zoölogy, and Economics; Trigonometry, Plane and Topographic Surveying; a reading knowledge of French or German. Students who upon entrance are deficient in Plane and Topographic Surveying may take the six weeks' summer course (Engineering 4*a*) at Squam Lake either before or immediately after their first year in Forestry. The rest of the preparatory subjects will usually have been covered during the college course.

The Division of Forestry will recommend for the degree of Master in Forestry a student who, having fulfilled these requirements, passes with credit in the courses enumerated in the following schedule:

PROGRAMME IN FORESTRY

FIRST YEAR

Autumn Term	**Winter Term**	**Spring Term**
Petersham	Cambridge	Petersham
1*a* (Oct., Nov.)	Botany 8 (Dec., Jan.)	1*c* (Apr. to June)
2 " "	Forestry 3*b* (Dec. to Apr.)	7*b* " "
8*a* " "	1*b* (Feb., Mar.)	
	7*a* " "	
	9 " "	

SECOND YEAR

Autumn Term	**Winter Term**	**Spring Term**
Petersham	Cambridge	Petersham
7*c* (Oct., Nov.)	4 (Dec., Jan.)	6*b* (Apr.)
Thesis " "	Thesis (con.) "	Seminar "
		Lumber Woods
	6*a* (Dec. to Apr.)	6*c* (May to June)
	5 (Dec. and Jan.)	
	Zoölogy 7*d* (Feb. and Mar.)	

DETAILED DESCRIPTION OF COURSES

FORESTRY

Courses Given at Petersham in the Harvard Forest

1*a*. Silviculture. *October and November.* Lectures, *two hours a week.* Field practice. Asst. Professor FISHER.

This course deals with the elements of silviculture as applied to the study, description, and treatment of wood crops. In lectures, field studies, and reports the following topics are taken up: factors governing forest growth and distribution; the silvics of local species; the principles of forest cuttings for improvement and reproduction.

1*c*. Silviculture. *April and May.* Lectures, *two hours a week.* Field practice. Asst. Professor JACK.

Course 1*c* deals with the theory and practice of propagating and planting the seedlings of forest trees for commercial purposes. Lectures and field work cover the following subjects: seeds, their collection, care, and germination; other modes of propagation; the formation and management of forest nurseries; commercial planting of seedlings or trees; planting plans. Spring work in the college nursery and in making plantations on open ground form the chief part of the field work.

2. Forest Measurements. *October, November, and part of April.* Lectures, *two hours a week.* Mr. ———.

The instruction in this course consists of lectures, field problems, and drafting room exercises. The following subjects are considered: —

Log scales — their use and the principles of their construction; practice in scaling; cordwood measurements.

Methods of obtaining the heights of standing trees; volume of felled trees; form factors. Principles and construction of volume tables.

Practice in estimating timber and mapping land; valuation surveys; construction of a timber map of a portion of the Harvard Forest.

Growth of single trees and of whole stands — stem analyses; construction and use of yield tables; location of permanent sample plots.

In April, during the sawing of the winter's cut of logs, the students study saw-mill practice for pine and hardwoods, and construct a mill scale.

Text-book: Graves's *Forest Mensuration.*

3*a*. Forest Botany. *October and November.* Lectures, *one hour a week.* Field practice. Asst. Professor JACK.

This course includes a study of the trees and shrubs growing in the Harvard Forest and adjacent region, so that the students may immediately become acquainted with the forest flora about them and the manner in which the different species are related to each other and their environment. Special attention will be given to their autumnal and winter aspects. Species regarded as forest weeds or of secondary importance must be studied so that the student may learn to discriminate between valuable species and those regarded as of small economic importance. The course will comprise lectures, laboratory and field exercises.

In April and May, upon the return of the class to the Harvard Forest after the winter in Cambridge, there will be examination and field reviews of the species studied in the autumn, particularly with reference to opening buds, vernation, inflorescence, and other features characteristic of the trees in the spring season.

7*b*. Forest Management. *April to June.* Lectures, *three hours a week.* Field work and computations. Asst. Professor FISHER and Mr. ———.

Course 7*b* involves the application of principles considered in Courses 2 and 7*a* to the construction of a working plan, a main feature of which is the calculation of increment. A portion of the Harvard Forest is mapped, divided into compartments, measured, and the proper cutting is prescribed on the basis of ascertained growth, silvicultural condition, and the financial and practical considerations involved in management.

7*c*. Forest Management. *October and November.* Conferences and field practice. Asst. Professor FISHER and Mr. ———.

In this course the students, in conferences and daily field work with the instructors, take part in the laying out and execution of the fall and winter logging in the Harvard Forest. The cut to be made according to the working plan is located on the ground, the trees are marked, and the logging and hauling are planned. The men then work with the foreman and woods crew so as to become familiar with felling, sawing, yarding, etc. The business and mechanical aspects of the work, in addition to the silvicultural and technical, are brought out in frequent conference and discussion.

A thesis, dealing either with the work of the course or with some other phase of forest management, is required in connection with Forestry 7*c*.

Courses Given at Cambridge

1*b*. Silviculture. *February and March.* Lectures, *three hours a week.* Asst. Professor FISHER.

Course 1*b* is a continuation of Course 1*a*. It aims to give a broad view of silvicultural method as derived from European standards, with special reference to its adaptability to American conditions. The forest regions of the United States are considered in detail from the points of view of distribution, composition, and reproduction, and the logging methods employed in each are studied in their relation to silvicultural treatment and result. Forest influences in the different regions are also discussed. The course is conducted wholly by lectures, outside reading, and conference.

3*b*. Forest Botany. *December to April.* Lectures, *two hours a week.* Field and laboratory work. Asst. Professor JACK.

In this course the dendrological studies will include a review of the forest trees of North America, particular attention being given to those of special economic value and to those closely associated with them. It is not the intention or expectation that students shall learn to identify at sight a large proportion of the species considered, although they are expected to learn to know some of the more common kinds, and to recognize the genera to which plants composing the forest flora belong, whether of useful or so-called useless species.

While a general review will be given of the trees composing the forests of North America, and close examination given to all of economic importance, the species of the Eastern States may receive particular attention and be taken as types for study, the shrubs as well as the trees, since it is important to be able to differentiate between trees and shrubs when all are small. Their identification in summer and winter aspects will receive special consideration, and also their different stages of growth, identification by fruits, seeds, seedlings, etc.

This course of instruction will include, in addition to lectures, laboratory work and field exercises at the Arnold Arboretum and in natural woods.

4. Forest Protection. *December and January.* Lectures, *three hours a week.* Asst. Professor JACK.

In this course the various kinds of injuries to trees and forests will be considered, including those caused by fire. Besides the history of forest fires, the causes, and the damages arising from them under different conditions and in different regions, will be reviewed and methods of prevention or control fully examined.

The injuries from climatic and seasonal influences; from wind, floods, shifting sand; the effects of grazing by sheep and other domestic animals in the forests, and also injuries by wild animals, will be considered, with special reference to known methods of control.

The chief insects and also the fungi and other pests recognized as particularly injurious to American trees and forests will be considered from a practical or economic standpoint.

In addition to lectures there will be study of material and field exercises.

5. Forest Economics. *December and January.* Lectures, *three hours a week.* Mr. BAILEY.

The subjects considered in this course are as follows: —

History of forestry in the European nations, in India, and in America; development of silviculture and methods of management; comparison of the forest legislation and of the administrative systems of the several countries.

National forest policy — the development of the land laws of the United States and of Canada; the National Forests and the United States Forest Service; organization and administration.

State forest policy; — systems of taxation; — fire laws.

6*a*. Lumbering and Woods Practice. *December to April.* Lectures, *five hours a week.* Mr. ———.

The practical work of this course consists in the study of and report upon a single large typical lumber operation, usually in New Hampshire or Maine. For this purpose three weeks are set apart in January.

The lectures cover the following topics: —

The natural conditions which affect the management of lumbering operations, *e.g.*, climate, topography, and conditions of labor.

The effect of prices of lumber, ownership of stumpage, and previous operations in the country.

The lumber-producing regions of the United States; their characteristic conditions upon which methods of exploitation depend.

The lumber business and its six main branches: stumpage, its purchase and sale; logging, felling, yarding, etc.; transportation to the mill; the saw mill; transportation from the saw mill to the market; the market. After a consideration of the broad principles which govern the business each of the six branches will be considered in detail. Methods of logging, constructing and operating mills, and transportation will be studied carefully for each of the lumber-producing regions of the United States. Special emphasis will be placed on costs and organization.

The principles of Forestry in their relation to the lumber business. A careful study will be made of such principles as are applicable to lumbering conditions in the United States at present under various kinds of ownership of forest lands.

In connection with this course a number of special lectures will be given by representative men in the lumber business who will discuss methods and conditions in the field of their own experience.

7*a*. Forest Management. *February and March. Three hours a week.* Asst. Professor FISHER and Mr. ———.

This course consists wholly of lectures, reading, and problems. Its object is to present the principles of forest finance and of forest regulation based upon the subject of Forest Measurements (Course 2) and underlying the preparation of the working plan (Course 7*b*).

The subjects considered are as follows: growth in its relation to income; the several classes of rotation; the normal forest; the chief foreign methods of regulating the yield; the determination of the value of forests and of the financial results of forestry.

BOTANY 8. Wood Structure. — Microscopic Features. *December and January.* Lectures, *four hours a week.* Laboratory work. Professor JEFFREY, Mr. BAILEY, and an assistant.

This course deals with the structural characters of wood as the basis of identification, and the foundation upon which the principles of wood-utilization depend. The study includes microscopic examination of the commercial woods of the United States. Each student is given a collection of permanently mounted microscopic slides which he may retain for future reference. The laboratory is provided with a complete collection of hand specimens of American woods which are used in the study of the macroscopic structure. The lectures in the course are illustrated by a collection of lantern slides made from micro-photographs of American woods. Through the knowledge of the structure and growth of wood, the arrangement of elements, the conductivity of fluids, the storage of foods, the deposits of resin, oils, etc., gained in this course, it is expected that the student will understand the reasons for differences in strength of wood, odor, color, grain, pulping values, extractive values, decay, seasoning, warping, checking, defects, infiltration, etc.

9. Forest Products. *February and March.* Lectures, *three hours a week.* Mr. BAILEY.

This course deals with the properties and utilization of commercial woods: —

The practical value and application of the knowledge of wood structure gained in Course 8; the properties and uses of wood, seasoning, kiln drying, decay, preservation, cooperage, and extraction of by-products.

The mechanical properties of wood, such as strength, compression, shearing, stiffness, hardness, toughness, etc.

The physical characters of wood, — color, grain, texture, odor, and resonance.

Normal and abnormal characters which are beneficial or harmful in timber, such as burls, birds-eyes, curly grain, shakiness, etc.

The chemical properties of wood; chemical composition of woody fibre; its use for various products, *e.g.*, cellulose, pulp, fuel, etc. Chemical deposits, such as resin, oils, etc., which are of value commercially.

The chief by-products of wood, — pulp, naval stores, tannin, products of distillation industries, etc.

Moisture in its relation to wood, — shrinking, seasoning, kiln drying, etc.

The preservation of wood and a study of the processes of decay. The attack of fungi and methods of preventing decay.

The methods of grading lumber. Study of the value and use of the most important commercial species. Price of the various species and grades. Various industries dependent on wood as a raw material. The substitutes for wood and possible uses for the less important species.

ZOÖLOGY 7d^2. Forest Entomology. Lectures, laboratory work, and demonstrations. *February and March. Tu., Th., Sat., and a fourth hour to be arranged with the instructor.* The lectures and laboratory work at the Bussey Institution. Mr. BRUES.

This course is designed to supply the more necessary knowledge of practical entomology to those intending to enter forestry as a profession. It deals with the insects which injure and destroy forests as well as those which attack their finished products, and the student is acquainted with both the general and special methods of insect control. The more important species affecting forests are taken up individually to insure their ready recognition, and in connection with each species the most satisfactory means of control are considered, so that the student may be able to cope with the problems which arise in the rational conservation of forests through the depredations of insects.

Given at Corbin Park, N.H.

6b. Forest Surveying and Timber Estimating. Mr. ———.

Course *6b* involves the application of the principles considered in Course 2 to the construction of forest maps and timber estimates of large areas of forest land. Methods of surveying and estimating forests will be considered both from the point of view of the ordinary lumbering and of the conservative management of lands under state and private control.

Given at the Harvard Engineering Camp by the Division of Engineering

ENGINEERING 4*a*. Surveying. — Use of Instruments; Plane and Topographical Surveying; Levelling; Map Drawing and Field Practice. *Six weeks, beginning as early as possible in June.* Asst. Professor HUGHES and assistants.

Course 4*a* is open to students who have studied Plane Trigonometry. This course comprises the study of the principles of surveying and the use and adjustment of instruments, with field practice. Beginning with approximate methods, the various kinds of surveys used in engineering work are made under supervision; the results are plotted in proper form on the map or plan, which is an essential part of every problem. The problems include paced, chain, tape, and stadia measurements; differential and profile levelling; land, road, and shore-line surveys with transit or compass and chain, tape, or stadia; plane-table, transit and stadia, and cross-section topographical surveys; adjustment of instruments; determination of position by astronomy; soundings and the use of the sextant; lettering and map drawing; the first principles of earth-work computation; the elements of simple curves.

Text-book: To be announced.

For full information regarding this and other courses given at Squam Lake, N. H., see the descriptive pamphlet of the Division of Engineering.

ADVICE TO INTENDING STUDENTS OF FORESTRY

To students in Harvard College who intend after graduation to pursue professional courses in Forestry, the Division recommends the following subjects of study, which, though not as a whole indispensable, constitute a highly desirable foundation for technical forestry: —

FIRST YEAR	SECOND YEAR	THIRD YEAR
Engineering 1*e* (*1st half*)	Engineeering 1*d*	Engineering 4*e*, 5*b*, 5*c*
Botany 1	Engineering *1e* (*2d half*)	Botany 3*a*, 3*b*
Geology *A*, *B*, 4, 5	Botany 2	Geology 1, 16
Physics 1 or *C*	Zoölogy 1, 2	Economics 1
English A	Chemistry 1	Land. Arch. 1
	Geology 6	½ course elective
	German *or* French	
	Engineering 3*a*	

Engineering 4*a*, in Summer.

Students contemplating the study of Forestry are urged to seek the advice of the Division that they may choose their courses with the best reference to their needs.

GENERAL INFORMATION

THE ARNOLD ARBORETUM

Professor **Charles S. Sargent**, *Director*

The Arnold Arboretum, which includes about 220 acres of land, offers opportunities for the field study of a large variety of hardy American and foreign trees and shrubs which do not occur in the Harvard Forest. They are mainly arranged in botanical groups and are available for study at all times of the year.

In addition to the general collections of hardy species, the nurseries contain many species under test for hardiness or other qualities which would render them economically valuable for cultivation in this country, either horticulturally or silviculturally. Besides the general living collection of woody species, the Arboretum has open to general view a collection of American woods; and it possesses an herbarium of ligneous plants and a dendrological library which are unexcelled in this country. The herbarium and library are open to students pursuing special work or investigations.

The Arnold Arboretum is located on the southerly side of Boston (Post Office address, Jamaica Plain). It is near the Forest Hills station of the N. Y., N. H. & H. R. R., and may be reached by taking Boston Elevated cars to the same point.

THE HARVARD FOREST

The Harvard Forest forms an important part of the equipment of the Division of Forestry. It was acquired in the autumn of 1907 through the generosity of Mr. John S. Ames, of North Easton, Mass., of the Class of 1901, who gave the money necessary for its purchase and an additional sum for the repair and outfitting of buildings. The land is situated in Petersham, Mass., and about 1800 acres of it were previously owned by Mr. James W. Brooks. In order to perpetuate the forest and render it useful both to the town and the cause of forestry, Mr. Brooks offered it to the University for a price substantially below its estimated sale value. At the same time owners of adjoining land, Messrs. J. J. Higginson, Edwin C. Dexter, Joseph C. Smith, Henry S. Bennett, Charles S. Waldo, and William Simes, and Mr. Brooks himself, offered to give contiguous lots and holdings amounting to between 200 and 300 acres. These gifts simplified the boundaries, secured the approaches, and rounded out the area of a demonstration-forest of about 2000 acres.

The forest lies on hilly country at an elevation varying from 800 to 1400 feet above sea level. It is divided into three distinct blocks of (about) 850, 550, and 600 acres, which are located, respectively, northeast, northwest, and southeast of the village. The northeast block covers the slopes and surrounding areas of Prospect Hill, the northwest block includes the basin of a small pond called Meadow Water, and the southeast block takes in about two miles of the narrow valley of the Swift River, with a pond and small water power along its course. The total stand of merchantable timber in the forest amounts to ten million board feet, nine tenths of it white pine, and the rest chestnut, red and white oak and other hard woods. About fifteen miles of good wood road provide access to almost any portion of the tract.

In managing the forest the policy is to carry on regular logging operations and other woods work looking toward the most productive handling of the forest, and in connection therewith to teach the elements and principles of technical forestry. Thus, the function of the whole tract, from the point of view of the professional student, might be compared to that of the hospital in medical study or of the mine in mining engineering: a working example on a liberal scale of the business in which the forester expects employment, accompanied by abundant chance for the study of the finer and more theoretic points of the science. To this main purpose the actual condition of the forest is strikingly well adapted. This is due in part to the fact that most of the timber can be very cheaply handled and commands a ready sale. But even more favorable is the unusually fortunate arrangement of the age-groups or different generations of timber. It so happens that stands of varying ages, from the small sapling to the mature tree, are almost equally represented on separate areas, so that an approach to a continuous yield can be secured in a short time. The Working Plan for the forest provides for the regular cutting of as much timber as the annual growth on the whole tract and the amount of growing stock on hand make expedient. The operations are entirely carried out by the Forest School, which maintains the nucleus of a permanent and experienced woods crew, with whom the students work during a part of the logging season. The cut is planned, located, and begun in the autumn, finished during the winter, and sawed in the spring. Thus each class follows one complete operation from the stump to the market, seeing it not only in its relation to silviculture and forest management but also to its practical execution and financial control.

Incidental to the main enterprise are improvement cuttings by which younger portions of the forest are gradually brought into good growing condition, and the plantation of commercial species, either upon blank or poorly stocked land or where reproduction cannot be easily secured by natural means. For the latter purpose, as well as for instruction, the School keeps a forest nursery, in which are raised both species to be grown commonly on the tract and others for experimental purposes.

EQUIPMENT AT PETERSHAM

The headquarters of the Division of Forestry at Petersham consist of a large three-story building, the two upper floors of which are divided into bedrooms, and the lower floor of which includes a dining room, two lecture rooms, a library, a living room, and an instrument closet. Adjoining the main house is a wing, and behind this are two barns for horses and cattle, and a storage shed for wagons, sleds, etc. The outfit for work includes all the instruments commonly used in forestry, a complete set of logging and woods tools, and such reference books as are needed in connection with the instruction given. The lecture rooms and library are furnished with work-tables, chairs, and bookcases. In each bedroom is an iron cot, a table, two chairs, two pails, and a lantern. There is a bath-room with running water on the second floor. A telephone provides communication with the village and with points on long-distance lines.

LIVING ARRANGEMENTS

The living arrangements are similar to those in a good engineers' camp. Each man is expected to supply his own bedding and look after his own room. Board is furnished at a reasonable rate. A small charge per month (see below) is made to cover rent, the use of furniture, light, and heat. Plain accommodations are offered not merely because they are suitable for the conditions of work, but for the sake of keeping the cost of living below what it would be in Cambridge. In this way the slight extra expense involved in transferring residence during the academic year is neutralized. During the winter term, the only one spent at Cambridge, lodgings can be got at reasonable rates in private houses near the College. The Harvard Dining Association and the Randall Hall Association provide board at cost. Although membership in these dates from the beginning of the academic year, it is usually possible to join in December, when the students of forestry return to Cambridge.

FEES AND EXPENSES

The tuition fee for students of forestry is $150 a year. Board and lodging at the Division headquarters in Petersham will average $5.50 a week. Besides these the only additional expenses (not counting personal items) are the fees for use of instruments, amounting to $5 a year, and the two woods trips during the second year of the programme, the combined cost of which comes to about $75. The table below gives the annual expenses connected with field work and instruction, only living expenses for the winter term at Cambridge, which will vary with the individual, being omitted: —

Tuition	$150.00
Room rent (charged upon the term-bills) 4 months @ $2.00	8.00
Board, 16 weeks @ $5.00	80.00
Instrument fees, etc	10.00
Railway fares between Cambridge and Petersham .	7.00
Woods trips (second year only)	75.00
	$330.00

PAYMENT OF THE TUITION-FEE

Each student liable for full tuition is required to pay three fifths of the tuition-fee to the Bursar punctually at the beginning of the academic year without the presentation of a bill.

Every student in the Graduate School of Applied Science whose work for the whole academic year is to amount to two full courses or more, is required to pay to the Bursar on or before September 29, 1910, $90, — without the presentation of a bill.

Every Graduate Student whose work for the whole academic year is to be *less* than two full courses is required to pay on or before September 29, 1910, **his entire fee for the year,** — without the presentation of a bill.

The first term-bill is issued January 20, and must be paid on or before February 10. This bill includes, in addition to the second instalment of the tuition-fee and half the year's charges for the use of a room at the headquarters building in Petersham, such charges as the following: fees for laboratory courses which begin in the first half-year; Stillman Infirmary fee; locker fees; such incidental charges as can then be determined; charges for gas, and for board at the Harvard Dining Association and the Randall Hall Association, made up to as late a date as practicable.

BONDS

Every student in Harvard College in regular standing must file with the Bursar a bond in the sum of *four hundred dollars*, signed by two bondsmen, one of whom must be a citizen of the United States, or by a surety company duly qualified to do business in Massachusetts, as security for the payment of College bills; or he may deposit with the Bursar four hundred dollars in United States bonds for the same purpose; or he may deposit *fifty dollars* as security and pay in advance all sums for which he becomes liable to the University. Money deposited as security is returnable after the issue of the second term-bill, one week before Commencement.

The same rule applies to every Special Student in Harvard College and every Resident Student in the Graduate Schools; except that *two hundred dollars* is the amount of the bond required of a student of one of these classes, unless he occupies a College room or boards at Memorial Hall or Randall Hall.

Every student in any department of the University who occupies a College room or boards at Memorial Hall or Randall Hall must file a bond for *four hundred dollars*, or must in advance, and in addition to his tuition-fees, pay the full year's rent of his room, and make a deposit as security for the payment of his board at the rate of *six dollars a week in the case of Memorial and five dollars in the case of Randall Hall.*

No officer or student of the University is accepted as a bondsman.

Students of Forestry who wish to come direct to Petersham from their homes may arrange the payment of the first instalment of the tuition-fee and the filing of a bond with the Bursar by mail. The Bursar's address is Dane Hall, Cambridge, Mass.

USE OF INSTRUMENTS

Students of Forestry are required to pay a fee to cover the ordinary wear on instruments used in the following courses: Forestry 2, 7*b*, 6*a*, 6*c*. This fee is $2.50 for each course. Each student is also liable for the costs on instruments lost or broken while charged to him; and as security for payment he must deposit at the beginning of the year, with the Chairman of the Division of Forestry, the sum of $5.00. At the end of the year this deposit, less whatever drafts have had to be made upon it, is returned to the depositor.

A laboratory fee of $5 is charged in Zoölogy 7*d*, and a small fee, as yet undetermined, will be charged for the use of laboratory material in Botany 8.

PERSONAL OUTFIT

For personal outfit at Petersham each student will need a pair of heavy camp blankets (or ordinary blankets supplemented by a cheap comforter), a belt axe or hatchet, a pocket compass, and a pocket magnifying glass. Every man is expected to have a bicycle, which is convenient at all times and essential in getting to and from the more distant parts of the forest. Sufficiently good second-hand wheels can usually be bought for from $6 to $12. As for wearing apparel, the essentials are hobnailed boots, flannel shirts, and whatever rough outside clothes the individual prefers. A slicker or poncho will be found useful. Note-books, stationery, drawing materials, etc., needed in the work of the courses can be purchased at the School building.

HOW TO REACH PETERSHAM

Petersham is situated in northern Worcester County, Massachusetts. Athol, on the Fitchburg Division of the Boston and Maine, is the nearest point to the Harvard headquarters. Stage and express teams carry passengers and baggage from Athol to Petersham at reasonable rates.

REGISTRATION

Students of Forestry are expected to register at the headquarters of the Division of Forestry in Petersham on Thursday, September 29, the first day of the academic year. In order that necessary arrangements may be made, it is desirable that students intending to register should notify the Chairman of the Division at least two weeks before the opening of the University.

OFFICIAL REGISTER
OF
HARVARD UNIVERSITY

VOLUME VIII APRIL 29, 1911 NUMBER 13

Walter Mulford

GRADUATE SCHOOL OF APPLIED SCIENCE

DIVISION OF FORESTRY

1911–12

Published by Harvard University
CAMBRIDGE, MASS.

OFFICIAL REGISTER OF HARVARD UNIVERSITY

[*Entered, March 24, 1905, at Boston, Mass., as second-class matter,*
under Act of Congress of July 16, 1894.]

Issued at Cambridge Station, Boston, Mass., twice a month from October to March inclusive, six times a month from April to September inclusive.

These publications include:—

- The Annual Reports of the President and of the Treasurer.
- The Annual University Catalogue.
- The Annual Catalogues of the College and the several Professional Schools of the University; the Descriptive Pamphlet; the Announcements of the several Departments; etc., etc.

INSTRUCTORS

RICHARD THORNTON FISHER, A.B., M.F., *Assistant Professor of Forestry*, and *Chairman of the Division of Forestry.*

EDWARD CHARLES JEFFREY, Ph.D., *Professor of Plant Morphology.*

JOHN GEORGE JACK, *Assistant Professor of Dendrology.*

HECTOR JAMES HUGHES, A.B., S.B., *Assistant Professor of Civil Engineering*, and *Director of the Engineering Camp.*

EDWARD EDGECOMBE CARTER, A.B., M.F., *Assistant Professor of Forestry.*

CHARLES THOMAS BRUES, S.M., *Instructor in Economic Entomology.*

IRVING WIDMER BAILEY, A.B., M.F., *Instructor in Forestry.*

———, *Instructor in Mechanical Engineering.*

GRADUATE SCHOOL OF APPLIED SCIENCE

DIVISION OF FORESTRY

GENERAL STATEMENT

The professional course in Forestry offered by Harvard University is organized with a view to meeting, and, in a measure, anticipating, developments in the field for employment. Forestry is still a new and not yet clearly established profession, and its progress depends very largely on the skill with which its pioneers meet the problems now confronting the chief forest owners of the country. At present the main employers of foresters are the National Government and the States. Private and corporate owners, although they take on each year an increasing number of trained men, employ so far relatively few. Yet it is likely that as forestry becomes recognized, and its practice financially justifiable, private work will offer an even more attractive opening than public. Whatever the field, success involves not only a thorough technical training, but also a practical insight into methods and conditions actually obtaining in the forest industries. Thus a forester who is to do the best constructive work, and contribute to the making of his own opportunities, should have had substantial experience in logging and the lumber business, at least for some one region, a fair training in the mechanical work incidental to forest operations, and, if possible, should have taken part in the application of intensive forestry to a given forest.

The arrangement of the course, which covers two years, is designed to give the student the maximum of field work and experience in connection with the management of the Harvard Forest at Petersham, supplemented by studies of typical large lumbering operations. More than half of each college year is spent in the woods. The winter months only are spent in Cambridge, where the time is devoted to lectures, laboratory, herbarium and arboretum work.

The course begins in June at Squam Lake, N.H., where plane and topographic surveying and simple railroad engineering are studied. The annual operations on the Harvard Forest, in which the students participate, include for the first-year men in October and November elementary work in dendrology, silviculture, and forest measurements, and in April and May, the construction of a working plan, forest planting and nursery work, practice in marking for cuttings, and work in the saw-mill. During the winter, from December 1 to April 1, and while the students are in Cambridge, the course includes wood structure, dendrology, the practice of forestry in the forest regions of the United States, the theory of forest management, the elements of simple construction engineering, and forest physiography.

In the autumn of the second year, at Petersham, the class plans and carries out the annual logging operation, taking part in the regular woods work of felling, sawing, yarding, etc., and conducts investigations of problems in technical forestry, the solutions of which can be immediately applied in the better handling of woodlands. The work in both practical and technical lines includes the preparation of reports, such as would be submitted to an employer. Upon the return to Cambridge, and in continuation of the elementary practical work carried out in the Harvard Forest, the class begins the study of general lumbering in its engineering, executive, and business aspects. This course consists of lectures, reading, and the careful study of a large, typical logging operation. For this purpose four weeks are spent during January in making a report upon the working and organization of a single company. This assignment follows introductory lectures on the broad principles governing methods and costs of lumbering and precedes subsequent work on lumbering in the different forest regions of the United States. In addition to lumbering, the winter term of the second year includes courses in forest products, forest protection, forest entomology, and forest policy and administration. The final spring term is devoted to an extended field problem involving the examination and valuation of a large tract of wild land, for which purpose the School has the use of Corbin Park, N.H., which is readily accessible from the Harvard Forest. This problem covers methods of woods surveying, the estimation of standing timber, and the study of the feasible methods of logging and management for the tract in question. Through this correlation of work in the two years' course a student is enabled to get an increasingly practical and clear knowledge of the underlying organization of typical forest industries. He is in close touch with the progress of the annual operations on the Harvard Forest, and his technical instruction is developed with constant reference to its use in a representative case.

The arrangement of the courses is designed to develop the foundations and principles of technical forestry, so far as possible during the first year, and during the second their application to the forest conditions of America.

ADMISSION

Membership in the Division of Forestry is open to men who are graduates of a college or scientific school in good standing. Other men of sufficient maturity and attainments, especially men with business experience and the definite purpose of entering the lumber business, who wish to obtain a broad view of lumbering and an insight into the principles by which in time it must be managed, may also be admitted by the Administrative Board of the School by special vote in each case. These men, though not candidates for the degree of Master in Forestry, will be given a certificate upon satisfactory completion of the course.

Students of special advanced subjects will be admitted to any courses for which their previous training fits them upon obtaining the approval of the Division.

PLAN OF STUDY FOR THE DEGREE OF MASTER IN FORESTRY

The preparation which is necessary and which must ordinarily be completed before entering upon the technical studies for the degree of Master in Forestry includes a satisfactory knowledge of Botany and Geology; elementary Physics, Chemistry, Zoölogy, and Economics; Trigonometry; English; and courses in at least two of the following languages: Latin, Spanish, French, or German.

The student usually enters the Forest School in June, registering at Squam Lake, N.H., for the Engineering courses, 4*a* and 4*g*, Plane and Topographic Surveying, and Logging Railroads. He may, if he chooses, postpone one or both of these courses until his second summer, or he may have covered the same ground as an undergraduate, in either of which cases he would enter the Forest School in September at Petersham. In no case will a student be allowed to enter the second year of the programme in Forestry without having had at least Engineering 4*a* and 4*g*, or their equivalents.

The Division of Forestry will recommend for the degree of Master in Forestry a student who, having fulfilled the entrance requirements, passes with credit in the courses enumerated in the following schedule: —

PROGRAMME IN FORESTRY

FIRST YEAR

Approximate Dates	Place	Courses
June 20 to Sept. 5	Engineering Camp, Squam Lake, N. H.	Engineering 4*a*, Engineering 4*g*.
Oct. and Nov.	Harvard Forest, Petersham, Mass.	Forestry 1*a*, Forestry 2, Forestry 3.
Dec. and Jan.	Cambridge, Mass.	Forestry 1*a*, Forestry 3, Forestry 9, Botany 8, Forestry 13.
Feb. and March.	Cambridge, Mass.	Forestry 1*a*, Forestry 3, Forestry 7, Forestry 9, Forestry 13.
Apr. to June 10.	Harvard Forest, Petersham, Mass.	Forestry 1*b*, Forestry 7.

SECOND YEAR

October.	Harvard Forest, Petersham, Mass.	Forestry 10, Forestry 11.
November.	Harvard Forest, Petersham, Mass.	Forestry 5, Forestry 10, Forestry 11.
December.	Cambridge, Mass.	Forestry 4, Forestry 5, Forestry 6.
January.	Lumber Woods,	Forestry 6.
February.	Cambridge, Mass.	Forestry 4, Forestry 5, Forestry 6, Zoölogy 7*d*.
March.	Cambridge, Mass.	Forestry 6, Zoölogy 7*d*.
April to June.	Lumber Woods.	Forestry 12.

DETAILED DESCRIPTION OF COURSES

FORESTRY

FORESTRY 1*a*. Silviculture.

October and November. Lectures, *two hours a week.* Field practice. Asst. Professor FISHER.

The first division of the course deals with the fundamentals of silviculture as applied to the study, description and treatment of wood crops. In lectures, field studies, and reports the following topics are taken up: factors governing the distribution, life history and growth of forests; silvics of local species; the principles of forest cuttings for improvement and reproduction; practice in the accurate analysis of forest conditions. This portion of the course is given in Petersham.

December to April. Three hours a week. Asst. Professor FISHER.

The second division of the course is based upon the work in the first. It aims to give a broad view of silvicultural method as derived from European standards, with special reference to its adaptability to American conditions. The forest regions of the United States are considered from the points of view of physiography and climate; distribution, composition and life history of the forests; forest influences peculiar to the region; silvicultural treatment and result as related to logging methods.

This portion of the course is given in Cambridge.

FORESTRY 1*b*. Forest Planting and Nursery Work. *April and May.* Lectures, *two hours a week.* Field practice. Asst. Professor JACK.

This course deals with the theory and practice of propagating and planting, particularly the seedlings of forest trees for commercial purposes. Lectures and field work cover the following subjects: seeds, their collection, care, and germination; other modes of propagation; the formation and management of forest nurseries; commercial planting of seed, seedlings or trees; planting of trees for other purposes, their kinds and adaptations. Planting plans. Work in the college nursery and in making plantations on open ground form the chief part of the field work.

This course is given in Petersham.

FORESTRY 2. Forest Measurements. *October and November.* Lectures, *two hours a week.* Field practice. Asst. Professor CARTER.

This course deals with the determination of the volume, in commercial units, of cordwood, logs, trees and stands, and of the growth of trees and stands. The lectures and field work will cover the following subjects: Cubic and cord measure as applied to trees, logs and stacked wood; the construction and use of log scales; the determination of the dimensions and volumes of standing trees; the construction and use of volume tables; methods of timber estimating; the determination of the growth of trees and of stands; the construction and use of yield tables.

In April, as part of Forestry 7, the students also study, during the sawing of the winter's cut of logs, the influence of saw-mill practice on the yield from logs, compare actual results with different log scales, and construct a mill scale.

This course is given in Petersham.

Text-book: Graves's *Forest Mensuration.*

FORESTRY 3. Dendrology.

October and November. Lectures, *one hour a week.* Field practice. Asst. Professor JACK.

This course includes a study of the trees and shrubs growing in the Harvard Forest and adjacent region, so that the students may immediately become acquainted with the forest flora about them and the manner in which the different species are related to each other and their environment. Special attention will be given to their autumnal and winter aspects. Species regarded as forest weeds or of secondary importance must be studied so that the student may learn to discriminate between valuable species and those regarded as of small economic importance. The course will comprise lectures, laboratory and field exercises.

In April and May, upon the return of the class to the Harvard Forest after the winter in Cambridge, there will be examination and field reviews of the species studied in the autumn, particularly with reference to opening buds, vernation, inflorescence, and other features characteristic of the trees in the spring season.

December to April. Lectures, *two hours a week.* Field and laboratory work. Asst. Professor JACK.

The course continues in Cambridge with a review of the forest trees of North America, particular attention being given to those of special economic value and to those closely associated with them. It is not the intention or expectation that students shall learn to identify at sight a large proportion of the species considered, although they are expected to learn to know some of the more common kinds, and to recognize the principal genera to which plants composing the forest flora belong, whether of useful or so-called useless species.

While a general review will be given of the species of trees composing the forests of North America, and close examination given to all of economic importance, the species of the Eastern States may receive particular attention and be taken as types, the shrubs as well as the trees, since it is important to be able to differentiate between trees and shrubs when all are small. Their identification in summer and winter aspects will receive special consideration, and also their different stages of growth, identification by fruits, seeds, seedlings, etc.

This course of instruction will include, in addition to lectures, laboratory work and field exercises at the Arnold Arboretum and in natural woods.

FORESTRY 4. Forest Protection. *December and January.* Lectures, *three hours a week.* Asst. Professor JACK.

In this course the various kinds of injuries to trees and forests will be considered, including those caused by fire. Besides the history of forest fires, the causes and the damages arising from them under different conditions and in different regions will be reviewed and methods of prevention or control fully examined.

The injuries from climatic and seasonal influences; from wind, floods, shifting sand; the effects of grazing by sheep and other domestic animals in the forests, and also injuries by wild animals, will be considered, with special reference to known methods of control.

The fungi and other pests recognized as particularly injurious to American trees and forests will be considered from an economic standpoint.

Some attention will be given to the proper pruning of trees and the care of trees, as individuals, which have been injured.

In addition to lectures there will be study of material, studies or demonstrations in the field, and practical work.

This course is given in Cambridge.

FORESTRY 5. Forest Policy and Administration. *November, December, and February.* Lectures, *three hours a week.* Assigned reading. Asst. Professor CARTER.

This course deals with the development of forest policies and administrative methods under the influence of economic and political conditions. The lectures include the following topics: forest legislation and administrative systems of selected foreign countries; the development of the public land laws of the United States and of Canada; the history of the National Forests; the present organization of the Forest Service, its administration of the National Forests and its other activities; the forest policies of representative states, including comparisons of their fire laws and systems of taxing forest property.

During November this course is given in Petersham. During December and February it is given in Cambridge.

FORESTRY 6. Lumbering and Woods Practice. *December to April.* Lectures, *five hours a week.* Mr. BAILEY.

The field work of this course consists in the study of and report upon the logging and milling operations of large lumber companies typical of the Eastern Forest regions of the United States. For this purpose four weeks are set apart in January.

The lectures cover the following topics:—

The natural conditions which affect the management of lumbering operations, *e.g.*, climate, topography, variety of timber, etc.

The economic conditions which affect the management of the lumber business, market conditions, nature of ownership, labor, previous treatment of the forest, custom, etc.

The lumber-producing regions of the United States; their characteristic features upon which methods of exploitation depend.

The lumber business and its six main branches: stumpage, its purchase and sale; logging, felling, yarding, etc.; transportation to the mill; the saw mill; transportation from the saw mill to the market; the market. After a consideration of the broad principles which govern the business each of the six branches will be considered in detail. Methods of logging, constructing and operating mills, and transportation will be studied carefully for each of the lumber-producing regions of the United States. Special emphasis will be placed on costs and organization.

The principles of Forestry in their relation to the lumber business. A careful study will be made of such principles as are applicable to lumbering conditions in the United States at present under various kinds of ownership of forest lands. A study will be made of experiments in conservative management in the United States in the endeavor to analyze them for causes of success or failure.

Except for the January field trip this course is given in Cambridge.

FORESTRY 7. Forest Management. *February to June.* Lectures, *three hours a week.* Field work and computations. Asst. Professors FISHER and CARTER.

This course deals with the preparation and execution of working plans for the management of forest property. The theoretical subjects of forest valuation and forest regulation, underlying the preparation of working plans, are discussed in lectures, supplemented by reading. The different forms of working plans are considered, especial consideration being given to those adaptable to American conditions. The students make a practical working plan for a portion of the Harvard forest. They map the area, divide it into compartments, and determine the amount of the present stand, its silvicultural condition, and probable future growth. Areas needing artificial reforestation are studied, and the best species and methods for the sites are determined. These data are then considered in their relation to possible financial profit or loss, market conditions, lumbering possibilities and the general policy for the Harvard forest, in outlining a plan for the actual management of the area.

During the sawing of the winter's cut of logs in April, advantage is taken of the opportunity to supplement the study of log scales in Forestry 2.

During February and March, this course is given in Cambridge. During April, May, and part of June it is given in Petersham.

BOTANY 8. Wood Structure. — Microscopic Features. *December and January.* Lectures, *four hours a week.* Laboratory work. Professor JEFFREY, Mr. BAILEY, and an assistant.

This course deals with the structural characters of wood as the basis of identification, and the foundation upon which the principles of wood-utilization depend. The study includes microscopic examination of the commercial woods of the United States. Each student is given a collection of permanently mounted microscopic slides which he may retain for future reference. The laboratory is provided with a complete collection of hand specimens of American woods which are used in the study of the macroscopic structure. The lectures in the course are illustrated by a collection of lantern slides made from micro-photographs of American woods. Through the knowledge of the structure and growth of wood, the arrangement of elements, the conductivity of fluids, the storage of foods, the deposits of resin, oils, etc., gained in this course, it is expected that the student will understand the reasons for differences in strength of wood, odor, color, grain, pulping values, extractive values, decay, seasoning, warping, checking, defects, infiltration, etc.

This course is given in Cambridge.

FORESTRY 9. Forest Products. *December to March.* Lectures, *three hours a week.* Mr. BAILEY.

This course deals with the properties and utilization of commercial woods: —

The practical value and application of the knowledge of wood structure gained in Course 8; the properties and uses of wood, seasoning, kiln drying, decay, preservation, cooperage, and extraction of by-products.

The mechanical properties of wood, such as strength, compression, shearing, stiffness, hardness, toughness, etc.

The physical characters of wood, — color, grain, texture, odor, and resonance.

Normal and abnormal characters which are beneficial or harmful in timber, such as burls, birds-eyes, curly grain, shakiness, etc.

The chemical properties of wood; chemical composition of woody fibre; its use for various products, *e.g.*, cellulose, pulp, fuel, etc. Chemical deposits, such as resin, oils, etc., which are of value commercially.

The chief by-products of wood, — pulp, naval stores, tannin, products of distillation industries, etc.

Moisture in its relation to wood, — shrinking, seasoning, kiln drying, etc.

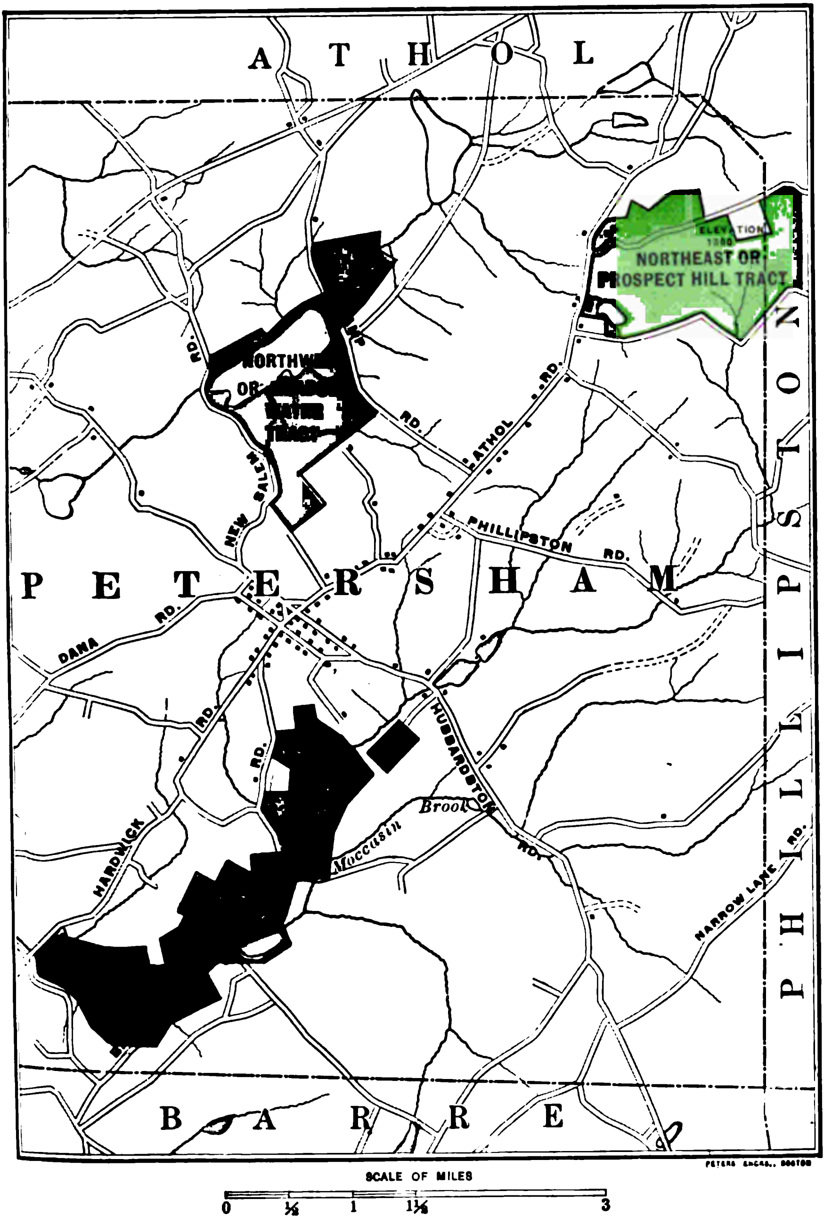
The preservation of wood and a study of the processes of decay. The attack of fungi and methods of preventing decay.

Study of the properties and uses of the most important commercial species. Various industries dependent on wood as a raw material. The substitutes for wood and possible uses for the less important species.

This course is given in Cambridge.

FORESTRY 10. Forest Operation. *October and November.* Conferences and field practice. Asst. Professor FISHER.

This course deals with the business of the operation of forest property under conservative management, as illustrated by the work on the Harvard forest. The students, in conferences and daily field work with the instructors, take part in the laying out and execution of the fall and winter logging. The cut to be made according to the working plan is located on the ground, the trees are marked, and the logging and hauling are planned. The men then work with the foreman and woods crew so as to become familiar with felling, sawing, yarding, etc. The business and mechanical aspects of the work, in addition to the silvicultural and technical, are brought out in frequent conference and discussion. Comparison will be made between the costs and methods of the work and those of previous years, and of other operations in the region.



HARVARD UNIVERSITY: HARVARD FOREST, PETERSHAM, MASS., 2,000 ACRES

Each student will submit reports covering the plans for the operation, and on various features of the work as it progresses.

This course is given in Petersham.

FORESTRY 11. Forest Investigations. *October and November.* Lectures, *three hours a week in October.* Conferences and field practice. Asst. Professor CARTER.

This course deals with the methods of investigating problems in technical forestry, with especial reference to American conditions. Examples of successful research by American and European foresters will be discussed, and the effect of these investigations in practical forestry will be pointed out. The records of the permanent experimental areas on the Harvard Forest will be reviewed, and the areas examined for additional data. New experiments will be started where advisable. Each student will make, under direction, at least one investigation of some question of technical importance, and will submit detailed reports of the methods used and results obtained.

This course is given in Petersham.

FORESTRY 12. Forest Surveying and Timber Estimating. *April and May.* Mr. BAILEY.

Course 12 is given at Corbin Park, N.H. It involves the application of the principles considered in Courses 2, 6, and 7 to the construction of forest maps and timber estimates of large areas of forest land. Methods of surveying and estimating forests will be considered both from the point of view of the ordinary lumbering and of the conservative management of lands under state and private control. Special emphasis will be placed upon rapid and accurate methods of topographic mapping and cruising, and upon the possible management of Corbin Park as an illustration

FORESTRY 13. Construction Engineering. *December to April.* Lectures, *three hours a week, with additional hours for laboratory and problem work.*

The object of this course is to give to students of Forestry sufficient familiarity with engineering principles to enable them to design and construct simple structures, such as foundations, small bridges of wood or wire, trestles, sheds, barns, etc., to conduct tests in the strength of timber, and to understand in a general way the construction, operation, and efficiency of boilers, hoisting engines, conveyors, pumps, gasolene engines, motors, and the transmission of power.

This course is given in Cambridge.

ENGINEERING 4*a*. Surveying. — Use of Instruments; Plane and Topographical Surveying; Levelling; Map Drawing and Field Practice. *Six weeks, beginning as early as possible in June.* Asst. Professor HUGHES and assistants.

Course 4*a* is open to students who have studied Plane Trigonometry.

This course comprises the study of the principles of surveying and the use and adjustment of instruments, with field practice. Beginning with approximate methods, the various kinds of surveys used in engineering work are made under supervision; the results are plotted in proper form on the map or plan, which is an essential part of every problem. The problems include paced, chain, tape, and stadia measurements; differential and profile levelling; land, road, and shore-line surveys with transit or compass and chain, tape, or stadia; plane-table, transit and stadia, and cross-section topographical surveys; adjustment of instruments; determination of position by astronomy; soundings and the use of the sextant; lettering and map drawing; the first principles of earth-work computation; the elements of simple curves.

Text-book: Tracy's *Plane Surveying.*

This course is given at Squam Lake.

ENGINEERING 4*g*. Logging Railroads. Field and Office Practice. *Five weeks, beginning Saturday, August 5.* Asst. Professor HUGHES and assistants.

Course 4*g* is open to students who have passed satisfactorily in Course 4*a* or its equivalent. In the summer of 1911 it will require five weeks. In following years it will require six weeks.

This course aims to give the student training in the location of logging railroads. Especial emphasis is placed upon field practice and upon simple and rapid methods of surveying and computation suited to the needs of the lumber business.

The instruction is intended to give the student ample experience in reconnaissance work; a general idea of paper location and profiles; practice in methods of computing earth work; simple curves, and in the calculation of costs and quantities. Special problem work will be given in the determination of frictional resistances and tractive forces.

ZOÖLOGY $7d^2$. Forest Entomology. Lectures and laboratory work. *February and March. Tu., Th., Sat., four hours, to be arranged with the instructor.* The lectures and laboratory work at the Bussey Institution. Mr. BRUES.

This course is designed to supply the more necessary knowledge of practical entomology to those intending to enter forestry as a profession. It deals with the insects which injure and destroy forests as well as those which attack their finished products, and the student is acquainted with both the general and special methods of insect control. The more important species affecting forests are taken up individually to insure their ready recognition, and in connection with each species the most satisfactory means of control are considered, so that the student may be able to cope with the problems which arise in the rational conservation of forests through the depredations of insects.

This course is given in Cambridge.

GENERAL INFORMATION

THE HARVARD FOREST

The Harvard Forest forms an important part of the equipment of the Division of Forestry. It was acquired in the autumn of 1907 through the generosity of Mr. John S. Ames, of North Easton, Mass., of the Class of 1901, who gave the money necessary for its purchase and an additional sum for the repair and outfitting of buildings. The land is situated in Petersham, Mass., and about 1800 acres of it were previously owned by Mr. James W. Brooks. In order to perpetuate the forest and render it useful both to the town and the cause of forestry, Mr. Brooks offered it to the University for a price substantially below its estimated sale value. At the same time owners of adjoining land, Messrs. J. J. Higginson, Edwin C. Dexter, Joseph C. Smith, Henry S. Bennett, Charles S. Waldo, and William Simes, and Mr. Brooks himself, offered to give contiguous lots and holdings amounting to between 200 and 300 acres. These gifts simplified the boundaries, secured the approaches, and rounded out the areas to an aggregate of about 2000 acres.

The forest lies on hilly country at an elevation varying from 800 to 1400 feet above sea level. It is divided into three distinct blocks of (about) 850, 550, and 600 acres, which are located, respectively, northeast, northwest, and southeast of the village. The northeast block covers the slopes and surrounding areas of Prospect Hill, the northwest block includes the basin of a small pond called Meadow Water, and the southeast block takes in about two miles of the narrow valley of the Swift River, with a pond and small water power along its course. The total stand of merchantable timber in the forest amounts to ten million board feet, nine tenths of it white pine, and the rest chestnut, red and white oak and other hard woods. About fifteen miles of good wood road provide access to almost any portion of the tract.

The primary object in the possession of this forest as part of the equipment of the Division of Forestry is its use as a field laboratory for the training of students in practical forestry. It furnishes a working example on a liberal scale of the business in which the forester expects employment, accompanied by abundant chance for the study of the finer and more theoretic points of the science. To this main purpose the actual condition of the forest is strikingly well adapted. Most of the timber can be logged cheaply, and its product marketed at a profit. The annual logging operations furnish an opportunity for the students to see and to take an active part in the application, on a commercial basis, of forestry principles to a forest tract typical of the region, and to become thoroughly familiar with the business of lumbering in that region. There is actual participation in the work of improving the producing capacity of a forest through careful and profitable use, and through planting new stands on barren areas. The costs and methods of present and past work can be compared with the results on the ground. The forest also furnishes an excellent opportunity for the training of students, through field practice, in surveying, mapping, estimating, and nursery work.

The forest as a whole furnishes a demonstration, of especial value to students of forestry, of the principle of sustained yield. It has a fortunate arrangement of age classes, or generations of timber, from small saplings to mature trees, in an almost unbroken series and on approximately equal areas. In handling the forest, this arrangement is to be continued and, so far as possible, improved.

Incidental to the main purpose fulfilled by the forest is the use of selected portions of it for research work in technical forestry. Long, as well as short, experiments can be started with assurance of permanency of ownership and policy. The forest is also of great value, as a demonstration of applied forestry, to the owners of timber land in New England and in other regions where similar forest conditions prevail.

THE ARNOLD ARBORETUM

Professor Charles S. Sargent, *Director*

The Arnold Arboretum, which includes about 220 acres of land, offers opportunities for the field study of a large variety of hardy American and foreign trees and shrubs which do not occur in the Harvard Forest. They are mainly arranged in botanical groups and are available for study at all times of the year.

In addition to the general collections of hardy species, the nurseries contain many species under test for hardiness or other qualities which would render them economically valuable for cultivation in this country, either horticulturally or silviculturally. Besides the general living collection of woody species, the Arboretum has open to general view a collection of American woods; and it possesses an herbarium of ligneous plants and a dendrological library which are unexcelled in this country. The herbarium and library are open to students pursuing special work or investigations.

The Arnold Arboretum is located on the southerly side of Boston (Post Office address, Jamaica Plain). It is near the Forest Hills station of the N. Y., N. H. & H. R. R., and may be reached by taking Boston Elevated cars to the same point.

EQUIPMENT AT PETERSHAM

The headquarters of the Division of Forestry at Petersham consist of a large three-story building, the two upper floors of which are divided into bedrooms, and the lower floor of which includes a dining room, two lecture rooms, a library, a living room, and an instrument closet. Adjoining the main house is a wing, and behind this are two barns for horses and cattle, and a storage shed for wagons, sleds, etc. The outfit for work includes all the instruments commonly used in forestry, a complete set of logging and woods tools, and such reference books as are needed in connection with the instruction given. The lecture rooms and library are furnished with work-tables, chairs, and bookcases. In each bedroom is an iron cot, a table, two chairs, two pails, and a lantern. There is a bath-room with running water on the second floor. A telephone provides communication with the village and with points on long-distance lines.

LIVING ARRANGEMENTS

The living arrangements are similar to those in a good engineers' camp. Each man is expected to supply his own bedding and look after his own room. Board is furnished at a reasonable rate. A small charge per month (see below) is made to cover rent, the use of furniture, light, and heat. Plain accommodations are offered not merely because they are suitable for the conditions of work, but for the sake of keeping the cost of living below what it would be in Cambridge. In this way the slight extra expense involved in transferring residence during the academic year is neutralized. During the winter term, the only one spent at Cambridge, lodgings can be got at reasonable rates in private houses near the College. Memorial Hall and Randall Hall provide board at cost. Although membership in these dates from the beginning of the academic year, it is usually possible to join in December, when the students of forestry return to Cambridge.

FEES AND EXPENSES

The tabulation below gives the cost of the two years' work in Forestry exclusive of living expenses. It is to be noted, however, that the charge for the surveying and engineering instruction at Squam Lake includes board and lodging for the session of eleven weeks. Board and lodging at the School headquarters in Petersham, where about seven months of the course are spent, cost $5.50 a week. In the final spring field work of two months the students live in camps or tents provided by the School, so that the living expense is considerably reduced. Travelling and other expenses connected with the study of lumber operations in the second year vary from $50 to $75. In all, during about eleven months of the course board and lodging will average from $5 to $5.50 per week.

FIRST YEAR

Engineering *4a* and *4g*, including 11 weeks' board and lodging (net cost)	$121.00
Tuition, balance of the year	150.00
Instrument fees, etc.	10.00
Railway fares	7.00
	$288.00

SECOND YEAR

Tuition	$150.00
Instrument fees, etc.	10.00
Maximum expense of woods trip	75.00
	$235.00

PAYMENT OF TUITION

CHARGES FOR SUMMER ENGINEERING COURSES

The regular fee for the courses given at Squam Lake during the summer of 1911 will be as stated below.

The fee covers instruction, board, laboratory fees, and all regular charges, and is subject to change every year.

For members of Harvard College who have paid a full year's tuition fee for the college year 1910–11:—

Engineering 4*a*	6 wks.	$66.00
" 4*g*	5	55.00

Special Fee.—A fixed charge in addition to the regular fee is made in the following cases:—

a. *For members of Harvard College* who have *not* paid a full year's tuition for the college year 1910–11.

b. *For men not members of Harvard College* on the date of opening Camp, June 24, 1911.

This *additional charge* for Engineering 4*a* and 4*g* is $20.00 each; making the total fee for the above classes of students as follows: for Engineering 4*a*, $86.00; for Engineering 4*g*, $75.00.

If any member of the Camp who has paid this additional charge enters the School of Forestry and pays a full year's tuition for the college year 1911–12, he may have the amount of the additional charge, $20.00, refunded at the end of the college year.

Every member of the Camp is required to pay for *repairs* or *replacement* of any *instrument* injured while charged to him, and for any camp *property* damaged by him. In acknowledgment of this responsibility a deposit of the sum of $5.00 is required of each student. All charges for damage must be paid promptly; and students are required to maintain this deposit during their connection with the Camp. This deposit will be refunded, if all claims against the student have been satisfied.

Payment is preferably made by check or express money order. These should be made payable to *The Harvard Engineering Camp* and should cover

1. *Regular Fee* for the courses elected;
2. *Special Fee* if due as defined above;
3. *The deposit of $5.00.*

The above fees and charges together with the deposit are due and must be paid on or before *June 20*, at 114 Pierce Hall, Cambridge, Mass.

Whenever possible, it is desired that remittance be made by mail to the same address.

CHARGES FOR THE REGULAR COLLEGE YEAR

Each student liable for full tuition is required to pay three fifths of the tuition-fee to the Bursar punctually at the beginning of the academic year without the presentation of a bill.

Every student in the Division of Forestry whose work for the whole academic year is to amount to two full courses or more, is required to pay to the Bursar on or before September 28, 1911, $90,—without the presentation of a bill.

Every Graduate Student whose work for the whole academic year is to be *less* than two full courses is required to pay on or before September 28, 1911, **his entire fee for the year,**—without the presentation of a bill.

The first term-bill is issued January 20, and must be paid on or before February 10. This bill includes, in addition to the second instalment of the tuition-fee and half the year's charges for the use of a room at the headquarters building in Petersham, such charges as the following: fees for laboratory courses which begin in the first half-year; Stillman Infirmary fee; locker fees; such incidental charges as can then be determined; charges for gas, and for board at the Harvard Dining Association and the Randall Hall Association, made up to as late a date as practicable.

BONDS

Every student in Harvard College in regular standing must file with the Bursar a bond in the sum of *four hundred dollars*, signed by two bondsmen, one of whom must be a citizen of the United States, or by a surety company duly qualified to do business in Massachusetts, as security for the payment of College bills; or he may deposit with the Bursar four hundred dollars in United States bonds for the same purpose; or he may deposit *fifty dollars* as security and pay in advance all sums for which he becomes liable to the University. Money deposited as security is returnable after the issue of the second term-bill, one week before Commencement.

The same rule applies to every Special Student and to every Unclassified Student in Harvard College and every Resident Student in the Graduate Schools; except that *two hundred dollars* is the amount of the bond required of a student of one of these classes, unless he occupies a College room or boards at Memorial Hall or Randall Hall.

Every student in any department of the University who occupies a College room or boards at Memorial Hall or Randall Hall must file a bond for *four hundred dollars*, or must in advance, and in addition to his tuition-fees, pay the full year's rent of his room, and make a deposit as security for the payment of his board at the rate of *six dollars a week in the case of Memorial and five dollars in the case of Randall Hall.*

No officer or student of the University is accepted as a bondsman.

Students of Forestry who wish to come direct to Petersham from their homes may arrange the payment of the first instalment of the tuition-fee and the filing of a bond with the Bursar by mail. The Bursar's address is Dane Hall, Cambridge, Mass.

USE OF INSTRUMENTS

Students of Forestry are required to pay a fee to cover the ordinary wear on instruments used in the courses involving field and draughting-room work. This fee is $5 for each year. Each student is also liable for the costs on instruments lost or broken while charged to him; and as security for payment he must deposit at the beginning of the year, with the Chairman of the Division of Forestry, the sum of $5.00. At the end of the year this deposit, less whatever drafts have had to be made upon it, is returned to the depositor.

A laboratory fee of $5 is charged in Zoölogy 7*d*, and a small fee, as yet undetermined, will be charged for the use of laboratory material in Botany 8.

PERSONAL OUTFIT

For personal outfit at Petersham each student will need a pair of heavy camp blankets (or ordinary blankets supplemented by a cheap comforter), a belt axe or hatchet, a pocket compass, and a pocket magnifying glass. Every man is expected to have a bicycle, which is convenient at all times and essential in getting to and from the more distant parts of the forest. Sufficiently good second-hand wheels can usually be bought for from $6 to $12. As for wearing apparel, the essentials are hobnailed boots, flannel shirts, and whatever rough outside clothes the individual prefers. A slicker or poncho will be found useful. Note-books, stationery, drawing materials, etc., needed in the work of the courses can be purchased at the School building.

REGISTRATION

The Engineering Camp at Squam Lake opens June 24, and students should arrange for registration and the payment of the Camp fees with Professor H. J. HUGHES, Pierce Hall, Cambridge, on or before June 20.

Students of Forestry are expected to register at the headquarters of the Division of Forestry in Petersham on Thursday, September 28, the first day of the academic year. In order that necessary arrangements may be made, it is desirable that students intending to register should notify the Chairman of the Division at least two weeks before the opening of the University.

10

OFFICIAL REGISTER OF HARVARD UNIVERSITY

VOLUME XI APRIL 30, 1914 NO. III, PART 5

GRADUATE SCHOOLS OF APPLIED SCIENC

SCHOOL OF FORESTRY

1914–15

PUBLISHED BY HARVARD UNIVERSITY
CAMBRIDGE, MASS.

SCHOOL OF FORESTRY

1914–15

PUBLISHED BY HARVARD UNIVERSITY
CAMBRIDGE, MASS.

OFFICERS OF ADMINISTRATION AND INSTRUCTION

Abbott Lawrence Lowell, A.B., LL.B., LL.D., Ph.D., *President.*

Richard Thornton Fisher, A.B., M.F., *Assistant Professor of Forestry*, and *Chairman of the School of Forestry.*

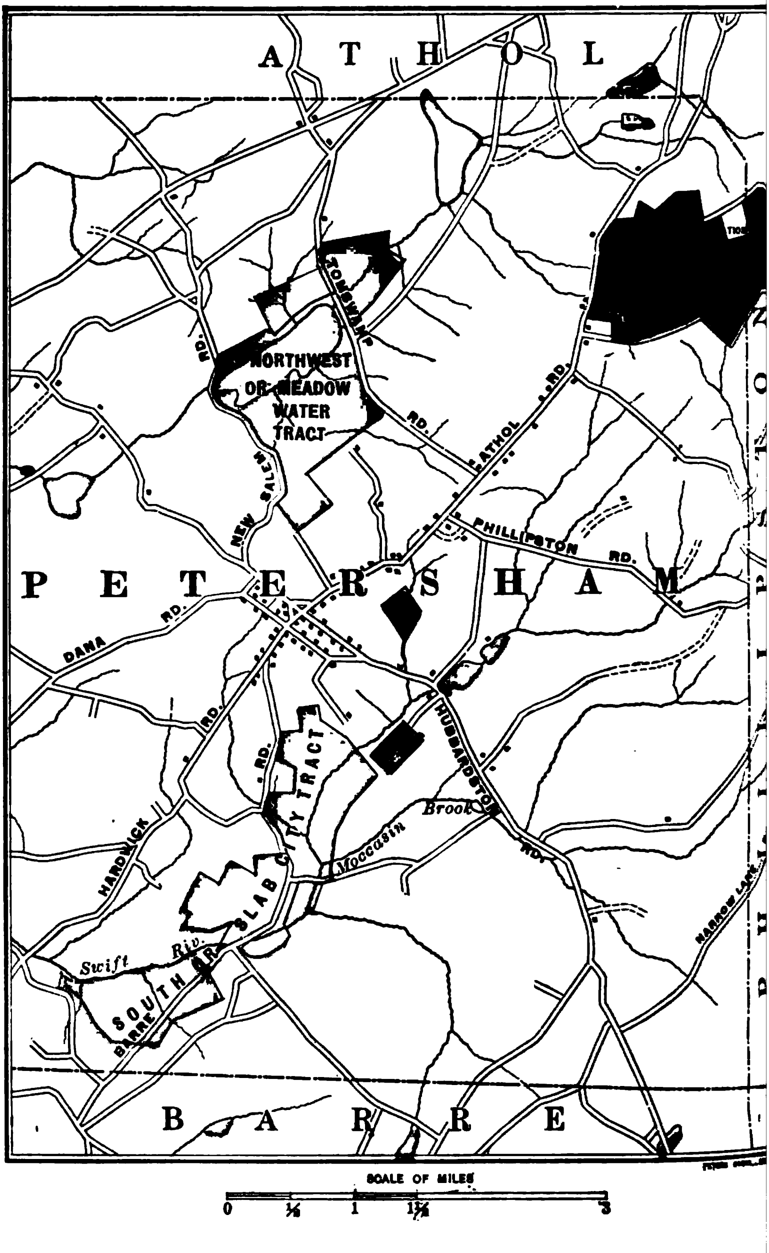
John George Jack, *Assistant Professor of Dendrology.*

Edward Edgecombe Carter, A.B., M.F., *Assistant Professor of Forestry.*

Irving Widmer Bailey, A.B., M.F., *Assistant Professor of Forestry.*

Charles Thomas Brues, S.M., *Assistant Professor of Economic Entomology.*

John Matthew Gries, A.M., *Lecturer on Lumbering.*



HARVARD UNIVERSITY: HARVARD FOREST, PETERSHAM, MASS., 2,000 ACRES

SCHOOL OF FORESTRY

GENERAL STATEMENT

With the year 1914–15, the Harvard School of Forestry will be organized exclusively for research and advanced instruction, and will no longer offer any formal curriculum for elementary and general training in forestry. The problems developing in connection with the economic handling of American forest resources have become so broad and varied that there has come to be a strong need not only for scientific investigation, but also for the application of specialized training to professional work. A large number of those who have so far taken up forestry as a profession — if one excepts those in the public service — have sooner or later found themselves in responsible positions in which specialized knowledge is highly important, and in which general technical forestry is useful rather as a background than as a tool. This is particularly true in the lumber business, in which, with the changes that have taken place in recent years, there has come to be a real demand for trained men. Men who have gone into consulting forestry have found work chiefly either in engineering and timber valuation, or in silviculture and protective treatment for estates and other non-commercial ownerships. Men who take up city forestry have dealt largely with questions of entomology and aboriculture. Men who have taken up teaching or service in the scientific activities of the government and states have also tended more and more to focus their work in special fields.

It is because of the need of research, the opportunity for specialists, and the possession of the exceptional equipment which the School now commands, that training is offered in the following special fields: —

Silviculture and management. This comprises the study of special problems in connection with investigative work, and results of practical operations on the Harvard Forest and similar forest lands of the northeast.

Wood technology: investigation and special training in problems underlying the development of improved methods of wood utilization. The work is centered in the technological laboratory of the School in the Bussey Building, but collateral training may be pursued with the Division of Chemistry, at the Arnold Arboretum, and with other Departments of the University.

Forest entomology: special problems and advanced training. The headquarters for work are in the entomological laboratories at the Bussey Institution, but for field material and auxiliary study there are available the Harvard Forest, the Arnold Arboretum, the museums of forestry, and the Boston Natural History Society, the Department of Zoölogy and the experimental work both of the Federal Parasitological Laboratory at North Melrose, of the State and of neighboring municipalities.

Dendrology: systematic studies in aborescent flora. Work in this field is conducted chiefly through the library, herbarium and out-of-door collections of the Arnold Arboretum, but may well include collateral study in the Harvard Forest and natural woods, as well as other local sources of material to which the School has access.

The lumber business. This is a two years' course combining thorough grounding in the principles underlying finance, methods, and organization, with extensive field training and investigation on particular problems in the operations of working companies. It is given in coöperation with the Harvard School of Business Administration.

TERMS OF ADMISSION

For entrance to the School of Forestry, a bachelor's degree from an institution of collegiate standing is required. This applies to all men who are candidates for degrees. Non-candidates for degrees who have had substantial professional experience and who are of sufficient maturity, may with the approval of the Council of the School be admitted as special students.

Arnold Arboretum

Bussey Building

WINTER QUARTERS OF THE SCHOOL OF FORESTRY

DEGREES

To graduates of schools of forestry, the degree of master in forestry will be given upon the completion of a year's work in silviculture and management, wood technology, entomology, and dendrology, the work being either exclusively in one of these fields, or in such combinations among them as the students' particular problems may require and the instructors may approve. Students electing the course in the lumber business, which is open not only to graduates of forest schools, but also to graduates of engineering schools and ordinary college graduates, will receive a degree only after finishing the full course of two calendar years. They will then be eligible, if they are holders of degrees in forestry, either for the degree of master in forestry, or for the degree of master in business administration, at their option. Those electing the course in the lumber business who are not holders of degrees in forestry, are eligible only for the degree of master in business administration. To men who hold only a general bachelor's degree, but who have had in their undergraduate work special preparation in botany, zoölogy, or chemistry and who, therefore, would be fitted to specialize in wood technology, entomology, or dendrology, the degree of Master of Science will be given upon completion of one year's approved work. The doctor's degree can be taken under the rules governing residence, amount and quality of work, as prescribed by the Faculty of Arts and Sciences. No degree is granted except upon the completion with credit of at least one full year's work.

DESCRIPTION OF FIELDS OF STUDY

Silviculture and Management. Asst. Professors Fisher and Carter.

The object of this specialization is to train men in the results and methods of investigation and research in scientific forestry as it relates to the production and maintenance of forest crops. The conduct of research is made the central feature of the training. For this purpose the Harvard Forest, with its diversified composition, its examples of the effect of silvicultural treatment and the absence of it, and its wide market relationships, serves as an exceptional field laboratory. Practical and investigative work is being carried on by the staff of the School, and the student in this field either gives his whole time to selected problems, except for such collateral work in other subjects as may be helpful, or, reciprocally, he may make use of the forest and its management as contributory material to other specializations. The following are lines of work for which abundant material is available. They may be considered either in the light of a basis for future work in silviculture and management, or as studies collateral to special work in utilization, entomology, or dendrology: —

Results under different methods of securing reproduction through cuttings.
Results under varied conditions of artificial reforestation.
The treatment of immature stands, both advance growth under forest cover, and young woods, including weedings, release cuttings, improvement cuttings, and thinnings.
The silvics of native species.
Methods of volume and yield determination.
Production under varied conditions of site, associations of species, and treatment.
Relation of merchantable volumes and values of timber to conditions of growth, such as soil, density, and species in mixture.
Utilization and milling methods as related to character of forests and to market.

The list of topics here given is not intended to be exhaustive or specific, but rather to indicate the many ways in which a student may adapt his specialized work to the character of his previous training, his interest, and his professional needs.

WOOD TECHNOLOGY. The Structure, Properties and Uses of Forest Products. Asst. Professor BAILEY and Dr. SINNOTT.

This course deals with advanced work on the structure, properties and uses of Forest Products. The subject may be considered with emphasis upon its scientific or upon its commercial aspects.

When emphasis is placed upon the scientific side, the students are assigned problems for original investigation. The object of the investigations is to secure information that bears directly or indirectly upon some one of the many difficulties that confront the users of forest products. For example, the fundamental factors which control the seasoning of wood, its preservative treatment, maceration, decay and conversion into various derivatives are at present imperfectly understood. The determination and study of these factors must lead inevitably to more efficient methods of utilization. Trees and other vascular plants are composed of tissues that are highly specialized and complicated anatomically and chemically. Available knowledge in regard to the structure and properties of these tissues is still comparatively meager. It is, therefore, obvious that the study of the anatomical and chemical structure and properties of plant tissues offers an attractive and as yet slightly explored field of research.

When emphasis is placed upon the commercial aspects of the subject, the student is assigned one or more problems for investigation in which careful studies are made of existing forest resources, the properties and uses of forest products and commercial practices and methods in the endeavor to discover more economical methods of utilization.

The student will in many cases find it advisable to combine the training given in this course with that given in other courses in applied biology, chemistry, physics, or business administration. For example, in connection with:

A. *Dendrology.* The declining supply of hardwoods in temperate regions is resulting in increased exploitation of tropical forests. There is, therefore, an increasing demand for a knowledge of tropical forests, and for men who can distinguish the numerous species of tropical trees and timbers, and who possess reliable information in regard to their properties and uses.

B. *Forest Entomology.* The investigation of many problems from the combined point of view of Entomology and Plant Anatomy may be expected to yield results of both theoretical and practical value.

C. *Silviculture.* The study of the properties and uses of forest products may be combined with a study of Silviculture by students who wish to determine the growth conditions or silvicultural methods which produce given properties or grades of commercial products.

D. *Plant Pathology.* The exact changes which occur in the structure of wood during the various stages of decay are not well understood, and an investigation of them may profitably be taken up in this course. The identification and life-histories of wood-destroying fungi can be studied under the direction of Professors Farlow and Thaxter in the department of Botany at Cambridge.

E. *Plant Physiology.* Of particular value to the student of the structure, properties, and uses of forest products is a working knowledge of the chemical structure of plant tissues. In many cases, therefore, the student will find it advisable to take Professor Osterhout's course in plant physiology.

F. Students who desire to emphasize the commercial aspects of the study of forest products may well select courses from the following: —

GENERAL LUMBERING. Commercial organization and methods in the United States. Asst. Professor CHERINGTON and Dr. COPELAND.

BUSINESS STATISTICS. Dr. COPELAND.

FOREST ENTOMOLOGY. Professor WHEELER and Asst. Professor BRUES.

There are many practical forestry problems in the United States whose solution must depend to a considerable extent upon the entomologist. Some are quite strictly entomological in their nature, but the majority are such that coöperation between men trained in both forestry and entomology is essential. It was with a realization of this fact that the present research course in forest entomology was inaugurated.

It includes no formal lectures and is designed to meet the requirements of students wishing to undertake advanced work on some special problem relating to forest entomology as a preparation for professional work in that field.

The location and equipment of the Bussey Institution offer facilities for work along several diverse lines. It is situated in a region where a number of important forest insects are very abundant, and the proximity of the Arnold Arboretum furnishes additional opportunities for the study of many other species on account of the very extensive collection of trees which are growing there. The laboratories are supplied with an insectary, where insects can be reared and experimental work carried on throughout the entire year. Field experiments on a larger scale may be performed in an adjacent area of woodland belonging to the Institution. Proper laboratory facilities can also be furnished for those desiring to do microscopic work, while the unequalled libraries and extensive insect collections available in Cambridge and Boston supply adequate means for taxonomic work on almost any group of forest insects.

At Petersham there are facilities for such laboratory work as must be done in connection with research in the Harvard Forest, although it will be advisable in many cases to utilize the fully equipped laboratories of the Bussey Institution to complete work done at Petersham.

New England has been visited during recent years by a number of imported insect enemies of trees, and the depredations of these pests which bid fair later to become of national importance have offered many opportunities for investigation which are of fundamental importance. In this way much has been learned concerning the gipsy and brown-tail moths, the leopard moth and the imported elm bark-bettle, but the student interested in what might be termed preventive entomology will find a number of questions relative to the control of non-native insect pests upon which he may profitably work either in the laboratory or in the field.

The planting and later management of forests involves certain entomological considerations which deserve attention, and along this line there are opportunities for investigation that may be undertaken from the standpoint of either experiment or observation. The Harvard Forest affords an ideal location for work of this nature which has hitherto received scant attention in any portion of the United States. Similar work on shade trees would also be of value, and could be conducted either at Petersham or Boston.

Forest entomology has received much less attention in America than either agricultural or horticultural entomology, and consequently offers very great opportunities for the student who wishes to specialize in this line of research. The life-histories, habits, and distribution of many of our important forest insects are as yet very inadequately known, and the actual effects of their depredations upon various trees require careful study. Satisfactory methods for the control of many species are yet to be devised and such methods must be based on extensive preliminary studies. Such work can be conducted both in the laboratory and the field. Taxonomic work on the earlier stages as well as on the adults of certain groups of forest insects is urgently needed to pave the way for more specific studies of individual species. The parasites of forest insects also demand much taxonomic work before their practical importance in the control of destructive forms can be understood.

Insects are important factors in the deterioration of standing timber and stored forest products, and in this field there is ample opportunity for research along several lines. They also bear a relation to the malformation and fungous diseases of trees, while the bacterial and fungous diseases to which insects themselves are subject are of great practical importance. Work along any of the latter lines can be pursued with profit by the student under the direction of Professors Farlow and Thaxter in the Department of Botany at Cambridge.

DENDROLOGY. Asst. Professor J. G. JACK.

Lectures, conferences, laboratory and field work in varying degree according to the demands of the subject or subjects chosen for study or investigation.

Students wishing to take advanced work in dendrology have the advantage of the very great facilities offered by the Arnold Arboretum in its living collections, its herbarium and library. As no other existing herbarium so well represents the North American ligneous flora, either in number of species or in their variation or their geographical range, as the living collection of hardy trees and shrubs is not excelled in North America, and as the library is the best in existence in books relating to dendrology, forestry and arboriculture, advanced students or specialists have here an unusual opportunity for research and monographic work. The living collections of the Arboretum are supplemented by those of the nearby parks of the City of Boston. The very large and comprehensive herbarium and library of the Gray Herbarium of Harvard University at Cambridge are always available for students, while additional opportunities for reference and study are offered in the libraries of the Massachusetts Horticultural Society, and other institutions in Boston and Cambridge.

The herbarium and library of the Arnold Arboretum are intended to illustrate the ligneous flora of all parts of the globe. Thus students have a wide range of material for study and research. They may elect to study the North American forest flora, or some portion of it in detail in its economic aspects, or from a taxonomic standpoint alone, involving a comprehensive survey or investigation or monograph work; or they may give attention to exotic subjects which have a bearing on forestry problems or dendrology. As the forests of the West Indies, Mexico, Central and South America, and of the Philippines are steadily commanding more attention, students contemplating work in these regions will need to gain an intelligent conception of the elements of their forest floras, and of studying and classifying material collected in them.

The very extensive collections of the ligneous flora of China and Japan in the herbarium of the Arboretum offer unexcelled opportunity for specialists in these interesting floras, either from the standpoint of systematic forest botany or comparative dendrology. Nowhere else, for instance, could the Chinese student of forestry find material brought together which so well and fully illustrated the varied oriental forest flora.

Specialists in Wood Technology, Forest Entomology or Forest Pathology, may coördinate their work by gaining familiarity with the botanical characters, variations, distribution, and so forth, of the forest trees, the woods of which they are investigating or which act as hosts to the insects, fungi or other diseases affecting them.

COURSES OF STUDY OR RESEARCH

Study of native and exotic trees and other woody plants adapted to the temperate regions of the United States, including seminal and other variations under varying geographic or ecologic conditions.

Systematic study of the ligneous flora of North America as a whole, or of particular regions in North America.

Study of subtropical and tropical forest floras.

Dendrology of special groups.

LUMBERING

With the changes that have taken place in recent years, the lumber business has come to offer an attractive field for trained men. In the earlier days of the industry, when timberland was abundant and relatively cheap, lumbering was largely a business of speculation in stumpage and the rise in the value of the timber often made up the bulk of the profit. Under such conditions the manufacture and distribution of the product did not require the highest efficiency of organization. Meanwhile, the supply of timber has become greatly reduced, the business of handling it has become very large and complicated, and the costs of operating have gone up rapidly. In the matter of labor alone, to say nothing of materials and other factors, wages have arisen and efficiency has fallen off. The result has been that, deprived of the support of cheap stumpage, lumber companies are being compelled to operate on a narrow margin of profit. To secure this profit is more and more plainly a problem of management, of manufacture, including logging and milling, and of distribution, including transportation and selling.

Under these circumstances, the problems of wood production, of providing for future supplies of timber, urgent though they are, must still appeal to the capital invested in lumber as secondary to the problems of management. The realization of this is already widespread, not only among lumbermen, but also among foresters, large numbers of whom have found that it is only in the operating or the business end that they have found employment with lumber companies. It is to meet the opportunity of this situation, and the demand expressed by many lumbermen throughout the country, that the Harvard School of Business Administration and the Harvard School of Forestry are offering in coöperation a two years' course of training for the lumber business. This course is open and recommended not only to college graduates who look forward to some branch of lumbering as a life work, but also to graduates of forestry or engineering schools with whose special training the instruction in the lumber business can very profitably be combined. While the programme of instruction with its courses in the Graduate School of Business Administration gives the general business foundation so essential to success in modern lumbering, it is of especial advantage to the student who desires to make the best use of his preparation, inclination, or connections that the opportunity of field training during the summer and the entire second half of the second year enables him to specialize. By putting the emphasis of his final work either on the operating or woods end of lumbering, on the manufacturing or saw mill end, or on the selling or marketing, he will focus his training on the field where he expects employment.

Programme of Courses for Students in Lumbering

First year:
- Accounting Principles.
- Marketing.
- Manufacturing (first half-year).
- General Lumbering (second half-year).
- Business Statistics (first half-year).
- Investments (second half-year).
- Principles of Forestry (for those who have not had previous work in Forestry).
- Summer field work in the lumber industry.

Second year: The first half-year in the Graduate School of Business Administration, electing such courses as
- Business Policy.
- Industrial Accounting.
- Corporation Finance.
- Manufacturing.

The second half-year is spent away from Cambridge. Each student is assigned a problem for field investigation upon which he is to write his graduation thesis under the supervision of the instructor.

The Courses in Detail

General Lumbering. Mr. J. M. Gries. Hours to be arranged.

The purpose of this course is to give the student a broad view of the lumber industry in the United States, not only its development and the conditions at present controlling it, but also the nature of the problems connected with its future management. The course is to serve as a foundation for the more specialized investigative work to be undertaken in the second year. The industry will be dealt with primarily from a descriptive point of view, and will be taken up with relation to the various lumber producing regions [illegible] the country. There will be considered the fundamental factors which have controlled the growth and character of the business, such as geographical location, settlement, topography, climate, [illegible] conditions of labor. The conduct of the business itself will fall under the following heads: stumpage, its purchase and sale, logging, including transportation to the mill, the sawmill, transportation of manufactured lumber, the market. In addition to a basis of information and general acquaintance with the organization of lumbering, which the exposition of these topics will give, the student will

A Thinning in a White Pine Stand 45 years old. Logs have been piled for hauling, cordwood has been cut from the tops, and the remaining slash has been burned.

Compartment 5, Meadow Water Tract

Sawmill and Mill Yard

Meadow Water Tract

receive through the assignment of subjects for study and report an introduction to the character of the problems which are in need of investigation and solution in the coming development of the lumber business, whether on the subject of logging, of manufacture, or of distribution.

PRINCIPLES OF FORESTRY. Professors FISHER, CARTER, JACK, and BAILEY. Hours to be arranged.

The purpose of this course is to give men intending to enter the lumber business an understanding of the aims and importance of applied forestry, and of the general methods governing its practice. Such an understanding should underlie intelligent coöperation with the development of forestry in the future. The general outline of the course is a summary of technical forestry: the chief species of American trees and their identification; the important commercial timbers, with the main facts about their structure, gross characters, and uses; the biological and other natural laws controlling the life of the forest and its influence on its surroundings; and the principles underlying the practice of forestry as an art and a business.

A survey of so large a field will necessarily be general, but many topics of peculiar interest and importance to men having to do with large timberland ownership will be fully developed. What are the most practicable methods of reproducing forests, and to what extent can they be profitably applied by a business concern ? What, as a matter of established fact, is the effect of forests upon the distribution of surface and ground water, and hence upon stream flow ? How does fire affect present and future conditions in the forest, and what are the most effective means of protection against it ? What is the comparative efficiency and accuracy of the chief methods of measuring and valuing timberlands ? What are the principles governing the legislative action of towns, states, and the Federal Government in respect to forests ? The forest is vitally related to the perpetuation of industry, not alone through its production of wood, and it is an understanding of the nature of this relationship that the course aims to give.

PROBLEMS OF THE LUMBER BUSINESS. Mr. J. M. GRIES and an assistant. (Second-year course during second half-year.)

This second-year course is intended to occupy the entire time of the second half-year, and to correlate and apply the previous instruction in the programme. As a basis for it, the student is expected to have spent the summer following the first year's work in the employment of some lumber company. The purpose of the course is to give the student training in analyzing and utilizing the facts in a given phase or phases of the business. The work will be entirely in the field, and the nature of it will be adapted by consultation with the instructors to the student's previous training and to the sort of professional work he has in view. Practical problems connected with the business will be assigned him for investigation.

These may involve work in the operations of a number of companies in different regions, or they may require devotion of the whole time to the organization of one concern. Students who have had forestry or an engineering training may be given work connected with the logging end of the business; such problems, for example, as methods of surveying and valuing timber tracts of different types; railroad location and construction; comparative efficiency of various types of logging machinery; relation of logging costs to yield of stand per acre and price of resulting products. Other students, who are college graduates, without special technical preparation, or whose interest centered in problems of management might profitably study such questions as organization plans, administrative methods, or an analysis of marketing methods.

As to the conduct of the work, each student will be in general charge of the instructor in lumbering with his assistants, who will direct the work in the field. The plan of work having been carefully settled, the student will be expected to make regular reports covering his progress. These reports will be criticised and commented upon, and the student will also be met at intervals for conference and discussion. The material and conclusion gathered in the investigation is embodied in a report, the construction and use of which will be an important element in his training.

ACCOUNTING

ACCOUNTING PRINCIPLES. Associate Professor COLE. Mon., Wed., and (at the pleasure of the instructor) Fri., at 11.

The purpose of this course is to indicate the fundamental and universal principles that accountants must use in their work. These are important for the manager who wishes either to direct his bookkeepers or to profit fully by the work of his accountants. Since, however, anyone who does not fully understand book-keeping terms and methods is in danger of misinterpreting accounting statements, because he does not appreciate the facts behind the figures, an examination of certain main types of book-keeping, with abundant practice in their use, forms a part of the year's work. The rest of the work is devoted to the study, not only of fundamental principles — such as the distinction between capital and revenue, the nature of maintenance and depreciation, the methods of sinking funds, the effect of interest on valuations, the basis of cost accounting, — but of the practical application of these principles to the enterprises in which they are most conspicuous, and of the accounting peculiarities of businesses of universal interest, such as banking, insurance, transportation, and investment.

The instruction is given by assigned readings, class discussions, and both class-room and outside written work.

The course is prescribed for all candidates for the degree of Master in Business Administration.

INDUSTRIAL ACCOUNTING. Associate Professor COLE. Half-course (first half-year). Mon., Wed., and (at the pleasure of the instructor) Fri., at 10.

Proper accounting for productive enterprises requires something more than the determination of costs. The accounts should show criteria not only for judging the effectiveness of labor and of materials and for determining the amounts and causes of waste, but also for establishing certain standards of both accomplishment and cost. This course begins with a continuance of the study of cost accounting principles begun in the course entitled Accounting Principles, and thus examines in fuller detail the common methods of ascertaining both prime costs and burden costs, and the common methods of distributing the latter over various products. It then passes to the choice of methods, and the application of the chosen methods, for particular types of industrial enterprise. It next studies for a few typical industries the accounting records necessary for adequate check on effectiveness of materials and of labor, and for the determination of standards. Attention will be given also to the content and form of operating reports for the guidance of various responsible officials and superintendents. Some attention will be given also to methods or devices for calculation, such as logarithms and the slide rule.

The course is open only to students who have taken Accounting Principles.

MARKETING

MARKETING (FIRST-YEAR COURSE). Asst. Professor CHERINGTON and Dr. COPELAND. Mon., Wed., Fri., at 9.

Prevalent commercial methods and typical marketing problems are studied in this first-year course. Although detailed in themselves, the questions discussed are in the main of more or less common occurrence, whereas in the later courses, for which this course provides the basis, more narrowly specialized but broadly interrelated problems are taken up.

An analysis is made of the markets for raw materials and finished products in a group of American industries, each of which is selected to illustrate some particular type of commercial organization. The services of each party participating in the assembling and handling of raw materials, the operations and functions of produce exchanges, the commercial significance of the size and location of plants, and, finally, the means whereby the products are distributed are the main features of the general plan followed in these analyses. The reasons for the methods used in each trade are sought, and the methods in different trades are contrasted. This leads to the subject of wholesale and retail distribution, to which the second half of the course is devoted.

The regular channels of trade are studied in detail, and are then compared with new forms of distribution. Wherein lie the advantages of the new types for carrying on particular trades? How is this competition being met? How are manufacturers securing dealer coöperation? Brand control, re-sale price policies, betterment of sales efficiency, advertising analyses, choice of mediums and other selling and advertising problems are discussed.

MANUFACTURING (FIRST-YEAR COURSE). Asst. Professor MARTIN. Half-course (first half-year). Wed., Fri., and (at the pleasure of the instructor) Mon., 4.30–6.

In this course a study is made of the organization and methods of production of the modern factory. In giving this instruction reliance is placed only partly on the traditional methods such as lectures, assigned reading, study of typical forms and systems, and personal conferences. At least equal importance is attached to the class-room discussion and criticism of the written reports of students. These reports are all based on inspections, under careful and detailed directions, of well-organized factories and embody the students' observations and suggestions.

The first topics considered are those relating to the location of the factory and the type of factory building and equipment. Questions of internal factory organization are next considered and especial attention is given to them. Next in order are the various problems involved in the economic and efficient management of the factory. In dealing with these problems some attention is given to modern systems of cost accounting, but the chief emphasis is laid upon methods and results in the efficient organization of labor, and in just relations between employer and employed.

A series of concretely presented illustrations of modern practice in factory management accompanies and follows the exposition of each of the topics considered.

BUSINESS STATISTICS. DR. COPELAND. Half-course (first half-year). Tu., Th., Sat., at 9.

Business management depends for its success upon a careful analysis of facts; and many of these facts can best be presented in statistical form. These statistics are at some points closely allied with accounting and cost determination, but they are used as distinctly different means of testing efficiency, detecting waste, and furnishing a guide for future plans. In practically every kind of business and by establishments of all sizes, properly selected statistics can be advantageously utilized. Opportunity is offered in this course for studying the principles which are to be observed in collecting, presenting, and interpreting statistics for business purposes. The work is closely correlated, without duplication, with that in many other courses in the School.

The application of sound statistical theory and practice to actual business problems is the object sought. A critical examination is made of systems of forecasting business conditions and of the commercial, industrial, and financial statistics of which they make use. Along with this subject and immediately subsequent to its conclusion, the leading principles of theory and method, which form the ground-work for the whole course, are outlined. Attention is then turned to the application of statistics to specific commercial and manufacturing problems. How is the capacity of a prospective market to be estimated ? Is the volume of trade in present markets showing proper expansion ? What sales records and what stock records are needed by the manufacturer, the wholesaler, and the retailer ? What statistics can the advertising manager use for selecting mediums and checking up results ? What purchasing records are to be kept, and how is it to be determined whether or not purchases are being made at the most opportune times ? What use is to be made of the reports of current operations in the factory ? Finally, which of these statistics ought to be presented to the chief executive and in what form ? Such questions as these are discussed, using specific examples drawn from different lines of trade and for establishments of various sizes.

Another feature of the work is the investigation by students of the growth and conditions of business in individual cities. The method of investigation is widely applicable and is essentially the same, whether in the interest of a chamber of commerce, a public service company, an investor, or of a manufacturer selecting a location for a plant or branch establishment.

In order to give the essential practice in collecting and handling statistics, a knowledge of the sources and methods to be used, and of the common abuses and errors to avoid, an important portion of the work consists in the preparation of reports and charts.

BUSINESS POLICY. Mr. A. W. SHAW and Asst. Professor MARTIN, and the following lecturers: Messrs. W. H. COTTINGHAM, H. S. DENNISON, P. E. FITZPATRICK, J. S. LAWRENCE, E. G. PRESTON, J. R. SIMPSON. Mon., Wed., Fri., at 9.

The dominant purpose of this course is to give second-year men an opportunity to focus upon actual business problems the knowledge already gained from the School and from their summer employment, and to give them a view of business from the position of the general manager.

An analysis of any business problem shows not only its relation to other problems in the same group, but also the intimate connection of groups. For example, not only is any problem of factory management related to other problems in the factory, and any problem of selling related to other problems in the sales department, but also, these groups of problems are interdependent. No problem in business is purely intradepartmental. Furthermore, within each department there must be preserved a uniform principle of balance. In preserving this balance it is necessary for the management to maintain a certain detached position where neither personal bias nor immersion in detail will affect the policy laid down. Finally, in analyzing the problem a definite and ordered method of approach is set up, and it is in the training toward the habitual use of this approach that this course has its chief value.

The instruction is by lectures, text-book, and especially by the study of actual problems that business men have considered and decided.

Following these problems each member of the class makes a brief oral report to the class upon the results of his research work in the subject assigned to him.

After this oral report, and after the points raised in class from discussion of that report have been further investigated, a written report is submitted to accompany the business data gathered.

In the second half-year begin the outside lectures by business men. Each lecturer takes charge of the class for a week or fortnight. These lecturers have aided in building up the course, and plan their work to fit into the general scheme of the course. They coöperate to make the course as dynamic as possible by submitting actual problems from their own desks, and by analyzing and discussing the policies suggested in writing by the class for meeting the problems.

In the second half-year, students who have done a certain quality of work are assigned to advisers conversant with the subjects in which the students are specializing. The advisers are the outside lecturers and other business men in Boston and the vicinity who have agreed to give a minimum of half an hour a week to one student of this course. With the consent of the instructor this course may be taken during the first half-year as a half-course.

INVESTMENTS. Mr. MOORS. Half-course (second half-year). Tu., Th., at 2.30.

This course aims to give the basis for forming a sound and conservative judgment in investment. It discusses such subjects as the various kinds of investment suitable for different persons; bonds and stocks; savings bank and trust investments; the factors constituting the value of securities; the history of typical securities; stock exchanges; brokerage, legitimate and illegitimate; the mechanism of the money market; booms and panics; the economic functions and dangers of speculation. On the part of the class, considerable practice work is expected in the analysis of corporation reports and similar material.

GENERAL INFORMATION

THE HARVARD FOREST

The Harvard Forest forms an important part of the equipment of the School of Forestry. It was acquired in the autumn of 1907 through the generosity of Mr. John S. Ames, of North Easton, Mass., of the Class of 1901, who gave the money necessary for its purchase and an additional sum for the repair and outfitting of buildings. The land is situated in Petersham, Mass., and about 1800 acres of it were previously owned by Mr. James W. Brooks. In order to perpetuate the forest and render it useful both to the town and the cause of forestry, Mr. Brooks offered it to the University for a price substantially below its estimated sale value. At the same time owners of adjoining land, Messrs. J. J. Higginson, Edwin C. Dexter, Joseph C. Smith, Henry S. Bennett, Charles S. Waldo, and William Simes, and Mr. Brooks himself, offered to give contiguous lots and holdings amounting to between 200 and 300 acres. These gifts simplified the boundaries, secured the approaches, and rounded out the areas to an aggregate of about 2000 acres.

The forest lies on hilly country at an elevation varying from 800 to 1400 feet above sea level. It is divided into three distinct blocks of (about) 850, 550, and 600 acres, which are located, respectively, northeast, northwest, and southeast of the village. The northeast block covers the slopes and surrounding areas of Prospect Hill, the northwest block includes the basin of a small pond called Meadow Water, and the southeast block takes in about two miles of the narrow valley of the Swift River, with a pond and small water power along its course. The total stand of merchantable timber in the forest amounts to about eleven million board feet, nine-tenths of it white pine, and the rest chestnut, white ash, red and white oak and other hard woods. About fifteen miles of good wood road provide access to almost any portion of the tract.

As to species the composition of the forest exemplifies, in consequence of its elevation above sea level and its geographical position, an interesting overlap between types characteristic of the north woods and those prevailing in Southern New England and the Middle States. Besides the white pine stands, which are the most abundant and productive on the tract, occur mixed pine and hardwoods, pure chestnut, mixed hardwoods, beech and hemlock, spruce and hemlock swamps, and a number of temporary types, such as poplar and birch, pure gray birch, and pitch pine. Typical Southern species are tupelo, sassafras, red cedar and shagbark hickory; typical Northern are paper birch, red spruce, larch, and red pine.

The age of the forest ranges from ten years on some recently cut over tracts to one hundred or more years on a few small areas where but little cutting has been done since early times. The greater part of the merchantable stand is from forty to seventy years old.

The primary object in the possession of this Forest as part of the equipment of the School of Forestry is its use as a field laboratory and experiment station. Owing to an unusually fortunate arrangement of age classes in the growing stock, and to excellent market and accessibility, the tract is operated on the principle of a sustained yield. Even at present annual and roughly equal cuts are made; and the amount of these will gradually increase. In adaptability to this intensive handling the Forest is very nearly unique in the United States.

With relation to technical work the property has the following functions: —

First, an experiment station, both for testing methods of forest production and for investigating problems in silviculture and management: To a large extent, the cutting areas of previous years, being under observation and record, form fruitful sources of data on the effects of different kinds of cutting upon the growth and reproduction of the forest. In addition, there have already been established a number of permanent sample plots for the study of such problems as comparative rates of growth of thinned and unthinned stands; relative development and responsiveness of advance growth of different species when released by cuttings; annual growth of selected species; relation of plantations to varying conditions of soil, ground cover, and shade. The School maintains a small nursery in which, in addition to the species grown for reforesting cut over or blank areas, a number of other commercial trees are raised for experimental purposes. The plantations, both commercial and experimental, now cover an area of about twenty acres, and these are extensively supplemented, for the purpose of observation and comparison, by many others, not only on lands immediately adjacent, but in the neighboring towns. One of the most notable of the many successful forest plantations in Massachusetts is that on the water shed of the Wachusett Reservoir at Clinton, where the Metropolitan Water Board has reforested over twelve hundred acres of vacant land with a stand of exceptional thriftiness and rapidity of growth. The material available from experimental work on the Harvard Forest, and the history of its management, as well as other examples of forest work in the same region, furnish a unique opportunity for men wishing to get special training in silviculture and management, not only with reference to New England conditions, but as bearing upon problems underlying intensive forestry in any part of the country.

Second, an increasingly instructive illustration of how scientific forestry is worked out in practice. The yearly business management, from the cutting to the marketing of the lumber, is controlled and recorded by a thoroughly up-to-date accounting and cost analysis system, such as is used by large companies; and journal and photographic descriptions are made of the silvicultural results of work in the woods, and of the annual changes which occur. In addition, the history of previous cuttings, both technical and financial, is available, so that the character of an organized forest can be more and more clearly understood.

Third, a near and varied market furnishes exceptional opportunity for the study of the relation of utilization to management. In Athol, the adjoining town, are factories manufacturing match blocks, boxes, furniture, sashes and blinds, and toys. These, with a constant demand for railroad ties and for cordwood, make intensive forestry practicable. Taken in connection with the logging and portable sawmill operations on the forest as well as on neighboring tracts, this market offers exceptional chances for the study of problems in the relation of sales and utilization to management. In such a study a man may familiarize himself with an important type of the lumber business, and one which is today peculiarly adapted to the practice of intensive forestry.

THE BUSSEY INSTITUTION

The headquarters of the School of Forestry during the winter term is the building of the Bussey Institution, in Jamaica Plain. It is located within two minutes' walk of the Elevated Railway and the N. Y., N. H. and Hartford R. R., so that it can be reached from the center of Boston in less than twenty minutes. The building is situated on a ridge of land overlooking the Arnold Arboretum in which the greater part of the dendrological work is conducted. All the instruction in forestry except for the field terms spent at the Harvard Forest and the course in lumbering, is given either at the Bussey Building or at the Arnold Arboretum. In the Bussey Building the School of Forestry has its lecture rooms, a technical reference library, and laboratory for wood technology. The equipment of the Department of Entomology, with which the School is now closely allied, is very varied. The laboratory has been recently equipped with the necessary microscopic, microphotographic, and chemical apparatus, with an insectary, and with cages and other appliances for use in the study of the life-histories and behavior of insects. In addition to the Institution's working library and collections, which are steadily growing, students engaged in investigation have access to the books and collections of the Museum of Comparative Zoölogy of the University and of the Boston Society of Natural History, institutions which offer exceptional facilities for entomological investigation.

In addition to these aids the student who is taking up applied entomology as a life work, has at his command a wealth of other resources which contribute greatly to broaden his interest in his chosen field. The Departments of Zoölogy, Botany, and Philosophy at Cambridge offer a large number of courses on subjects vitally connected with entomology. To mention only a few of these, there are in the Zoölogical Department thorough courses in comparative anatomy, cytology, embryology, and the sensory reactions of animals, and in the Division of Philosophy several courses in comparative psychology which are essential to a scholarly understanding of insect structure and behavior.

Still other resources are furnished by the Federal Parasitological Laboratory at North Melrose, an institution for the study of practical methods of controlling the depredations of the gypsy and brown-tail moths. Through coöperation with the workers in this laboratory the Bussey Institution is able to bring the student into close touch with one of the greatest and most interesting experiments that has ever been undertaken in man's warfare with injurious insects. The Cambridge Entomological Club, which has its headquarters at the Bussey Institution, enables the student to establish personal relations with the working entomologists of New England and to profit by an intimate acquaintance with the work of numerous specialists in his chosen field.

Although the main object of the Bussey Institution is research, it is not deemed advisable to dispense with all formal lectures and laboratory work. Several courses are therefore given for the purpose of providing both preliminary training in economic entomology and an acquaintance with the methods and aims of entomological science in general.

THE ARNOLD ARBORETUM

Professor Charles S. Sargent, *Director*

The Arnold Arboretum includes about two hundred and twenty acres of land, which territory mostly belongs to the Bussey Institution of Harvard University, but has been dedicated by the University (in 1872 and 1896) to the formation of a collection or museum of living trees and other woody plants adapted to the climate of New England, or the northern parts of North America. Here have been conducted in the past and here are still in experimental stages many tests in acclimatization.

At present these living collections contain approximately three hundred genera and about five thousand species and varieties or forms of trees and shrubs, which will grow in cool temperate climates. They are mainly arranged in groups according to botanical relationship and are available for study at all times of the year. For convenient comparison and popular use there is a fruticetum, or collection of shrubs, arranged together in botanical sequence and containing about one thousand species and varieties or forms. There are also numerous supplementary collections of shrubs arranged in various parts of the Arboretum.

The nurseries contain many species under test for hardiness or other qualities which would render them economically valuable for cultivation in this country, either horticulturally or silviculturally.

Besides the living outdoor collections there is a small propagating house where propagating by different methods is carried on for the purpose of increasing the collections or as tests.

The herbarium, and library, and general offices of the Arboretum are quartered in a fire-proof building at its northeastern extremity. The herbarium was first largely augmented by collections of specimens procured in getting data and material for the Tenth Census (1880) and the Jesup Collection of North American Woods for the American Museum of Natural History.

The later preparation and publication of the *Silva of North America* necessitated the further accumulation of a great amount of material from all parts of the country, and this has yearly been greatly increased by the collections of many botanists in expeditions to regions which have not been well explored. Various expeditions to China and Japan, with their floras showing close relationships with the flora of North America, have made the Arboretum herbarium first in importance in displaying the dendrological riches of these oriental countries.

Altogether, through its own collectors or by purchase or exchange with other scientific institutions, the Arboretum has now an herbarium of about one hundred and ten thousand mounted specimens. There is also open to general view a collection of specimens of the woods of North American trees, supplementing those in use in the course on Wood Technology.

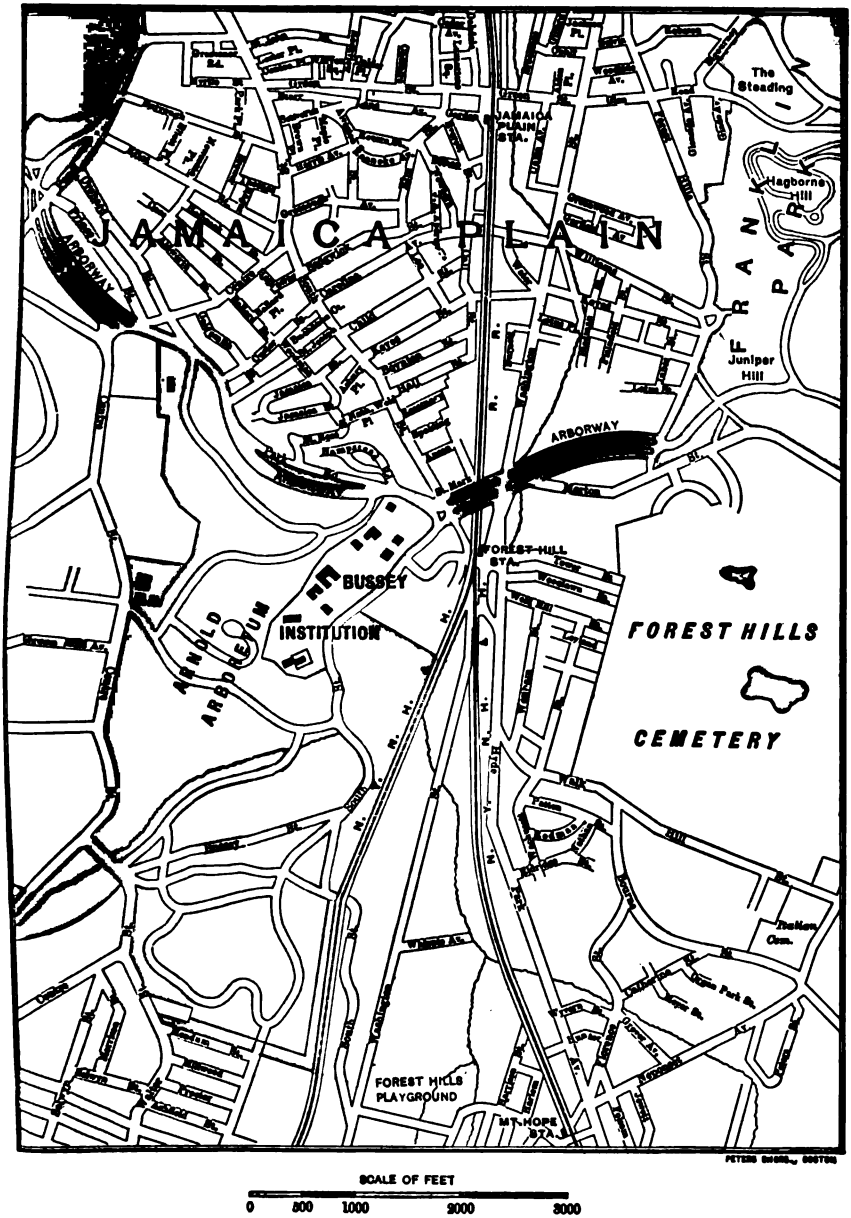
The library contains approximately thirty thousand bound volumes relating to dendrology, forestry and arboriculture. In these subjects it is not equalled by any other in America and students or specialists taking advanced work in the study of woody plants have facilities offered in this great library which cannot be found elsewhere.

EQUIPMENT AT PETERSHAM

The headquarters of the School of Forestry at Petersham consist of a large three-story building, the two upper floors of which are divided into bedrooms, and the lower floor of which includes a dining room, two lecture rooms, a library, a living room, and an instrument closet. Adjoining the main house is a wing, and behind this are two barns for horses and cattle, and a storage shed for wagons, sleds, etc. The outfit for work includes all the instruments commonly used in forestry, a complete set of the logging and woods tools used in the region, and such reference books as are needed in connection with the instruction given. The lecture rooms and library are furnished with work-tables, chairs, and bookcases. In each bedroom is an iron cot with pillow and mattress, a table, two chairs, pails, and a lamp. There is a bathroom with running water on the second floor. A telephone provides communication with the village and with points on long distance lines.

LIVING ARRANGEMENTS

Each man is expected to supply his own bedding and look after his own room. Board is furnished at a reasonable rate. A small charge per month (see below) is made to cover rent, the use of furniture, light, and heat. Plain accommodations are offered not merely because they are suitable for the conditions of work, but for the sake of keeping the cost of living within reasonable limits. When



HARVARD UNIVERSITY: BUSSEY INSTITUTION AND ARNOLD ARBORETUM, 394 ACRES the headquarters are at Jamaica Plain, board and lodging can be obtained at moderate rates in private houses; and a limited number of men will find comfortable quarters in the new dormitory building recently equipped and furnished within the grounds of the Bussey Institution. In this it is hoped to establish a mess for the coming year. Men who prefer may live in Cambridge or Boston, since the Boston Elevated now makes communication among the three places very convenient.

FEES AND EXPENSES

Tuition for a year's work is $150. Board and lodging at the School headquarters in Petersham cost about $6.00 per week, of which .75 is the fixed charge for room rent, etc. The prices of furnished rooms in the dormitory building at Jamaica Plain vary from $8.00 to $16.00 a month, according to the size of the rooms, a number of which are double. The price of board at the mess has not yet been determined, but will be fixed as nearly as possible at cost. Outside board and lodging will vary according to the requirements of the individual from $6.00 a week up. The cost of living during the field studies of the course in the lumber business cannot be exactly stated in advance, but as a rule the living expenses will be much lower than in town, usually not over $5.00 a week, and the cost of travel will depend upon the location chosen for work.

Charges for the Regular College Year

Each student liable for full tuition is required to pay three-fifths of the tuition fee to the Bursar punctually at the time of registration without the presentation of a bill.

Every student in the School of Forestry is required to pay to the Bursar on or before September 28, 1914, $90, without the presentation of a bill.

The first term-bill is issued January 20, and must be paid on or before February 10. This bill includes, in addition to the second instalment of the tuition fee and half the year's charges for the use of a room at the headquarters building in Petersham, such charges as the following: fees for laboratory courses which begin in the first half-year; Stillman Infirmary fee; locker fees; such incidental charges as can then be determined; charges for gas, and for board at Memorial Hall and at Foxcroft Hall, made up to as late a date as practicable.

BONDS

Every student of Forestry in regular standing must file with the Bursar a bond in the sum of *two hundred dollars*, signed by two bondsmen, one of whom must be a citizen of the United States, or by a surety company duly qualified to do business in Massachusetts, as security for the payment of College bills; or he may deposit with the Bursar two hundred dollars in United States bonds for the same purpose; or he may deposit *fifty dollars* as security and pay in advance all sums for which he becomes liable to the University. Money deposited as security is returnable after the issue of the second term-bill, one week before Commencement.

Every student in any department of the University who occupies a College room or boards at Memorial Hall or Foxcroft Hall must file a bond for *four hundred dollars*, or must in advance, and in addition to his tuition fees, pay the full year's rent of his room, and make a deposit as security for the payment of his board at the rate of *six dollars a week in the case of Memorial Hall and five dollars in the case of Foxcroft Hall.*

The same rule applies to every Special Student and to every Resident Student in the Graduate Schools; except that *two hundred dollars* is the amount of the bond required of a student of one of these classes, unless he occupies a College room or boards at Memorial Hall or Foxcroft Hall.

No officer or student of the University is accepted as a bondsman.

Students of Forestry who wish to come direct to Petersham from their homes may arrange the payment of the first instalment of the tuition fee and the filing of a bond with the Bursar by mail. The Bursar's address is Dane Hall, Cambridge, Mass.

USE OF INSTRUMENTS

Students of Forestry are required to pay a fee to cover the ordinary wear on instruments used in field and draughting-room work. This fee is $5 for each year. Each student is also liable for the costs of instruments lost or broken while charged to him; and as security for payment he must deposit at the beginning of the year, with the Chairman of the School of Forestry, the sum of $5.00. At the end of the year this deposit, less whatever drafts have had to be made upon it, is returned to the depositor.

PERSONAL OUTFIT

For personal outfit at Petersham each student will need a pair of heavy camp blankets (or ordinary blankets supplemented by a cheap comforter), a belt axe or hatchet, a pocket compass, and a pocket magnifying glass. As for wearing apparel, the essentials are hobnailed boots, flannel shirts, and whatever rough outside clothes the individual prefers. A slicker or poncho will be found useful. Note-books, stationery, drawing materials, etc., needed in the work of the courses can be purchased at the School building.

REGISTRATION

Students of Forestry are expected to register at the headquarters of the School of Forestry in Petersham or at the Bussey Building in Jamaica Plain on Monday, September 28th. In certain cases, and with the approval of the council of the School, registration at other times of the year is permissible. In order that necessary arrangements may be made, it is desirable that students intending to register should notify the Chairman of the School at least two weeks before the date of registration.

HOW TO REACH PETERSHAM

The railroad station for Petersham is Athol on the main line (Fitchburg Division) of the Boston and Maine Railroad. Athol is two hours and three-quarters from Bosten, and about three and a half from Albany. It is accessible from the north and south via Greenfield on the Connecticut River Division of the Boston and Maine. The school buildings are six miles from the Athol depot.

OFFICIAL REGISTER OF HARVARD UNIVERSITY

VOLUME XI AUGUST 10, 1914 NO. I, PART 30

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

1914–15

FINAL EDITION

RECEIVED
NOV 25 1914
Division of Forestr
University of Californ

PUBLISHED BY HARVARD UNIVERSITY
CAMBRIDGE, MASS.

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

OF

HARVARD UNIVERSITY

FINAL EDITION

RECEIVED
NOV 25 1914
Division of Forestry
University of California

CAMBRIDGE
PUBLISHED BY THE UNIVERSITY
1914

CONTENTS

PAGE

CALENDAR 5

FACULTY AND SPECIAL LECTURERS 6

GENERAL STATEMENT 10

ACADEMIC YEAR 11

ADMISSION OF STUDENTS 11

REGISTRATION 12

REQUIREMENTS FOR THE DEGREE 13

RECOMMENDATIONS AS TO PREPARATORY STUDIES 13

PROGRAM OF INSTRUCTION 15

DESCRIPTION OF COURSES 18
- Accounting 18
  - Accounting Principles 19
  - Accounting Practice 19
  - Industrial Accounting 20
  - Accounting Problems 20
- Law 21
  - Commercial Contracts 22
  - Law relating to Business Associations 23
  - Law relating to Banking Operations 24
  - Law relating to Railroad Rate-Making 24
- Marketing 25
  - Marketing (first-year course) 25
  - Marketing (second-year course) 26
- Industrial Management 27
  - Factory Management (first-year course) 28
  - Factory Management (second-year course) 29
  - The Taylor System of Management 29
- General Business Problems 30
  - Business Statistics 31
  - Business Policy 32
- Foreign Trade 33
  - Foreign Trade Methods 34
  - European Trade 34
  - Latin-American Trade 35

PAGE
DESCRIPTION OF COURSES (Continued)
Banking and Finance 37
Banking 37
Investments 38
Corporation Finance, with Especial Reference to Railroad Companies 38
The Financial Management of Local Public Service Corporations 39
The Financial Management of Industrial Corporations . . . 40
Insurance 40
Fire Insurance 41
Fire Insurance Engineering 41
Life Insurance 42
Actuarial Practice 43
Transportation 43
Railroad Organization 44
Railroad Operation 45
Analysis of Railroad Problems 46
Railroad Rate-Making 46
Railroad Accounting 47
Printing and Publishing 48
Printing and Publishing (first-year course) 48
Printing and Publishing (second-year course) 49
Courses for Secretaries of Chambers of Commerce 50
Chamber of Commerce Work and Methods 51
Chamber of Commerce Problems 51
Local Public Utilities 52
Public Utilities Operation 52
Lumbering 53
General Lumbering 54
Principles of Forestry 55
Problems of the Lumber Business 55
BUREAU OF BUSINESS RESEARCH 57
LIBRARY FACILITIES 58
SUMMER EMPLOYMENT FOR STUDENTS 59
POSITIONS FOR STUDENTS AND GRADUATES 59
PRIZES 60
LOAN FUND AND OTHER PECUNIARY AIDS 61
FEES 62
STUDENTS 66
DEGREES 73
TABULAR VIEW OF CLASS EXERCISES 74

1914

JULY

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	..
..	..	..	..	..	..	..

AUGUST

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	..	..	..	..	..

SEPTEMBER

Su	Mo	Tu	W	Th	Fr	Sa
..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	..	..	..
..	..	..	..	..	..	..

OCTOBER

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
..	..	..	..	..	..	..

NOVEMBER

Su	Mo	Tu	W	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	..	..	..	..	..
..	..	..	..	..	..	..

DECEMBER

Su	Mo	Tu	W	Th	Fr	Sa
..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	..	..
..	..	..	..	..	..	..

1915

JANUARY

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	..	..	..	..	..	..

FEBRUARY

Su	Mo	Tu	W	Th	Fr	Sa
..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	..	..	..	..	..	..
..	..	..	..	..	..	..

MARCH

Su	Mo	Tu	W	Th	Fr	Sa
..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	..	..	..
..	..	..	..	..	..	..

APRIL

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	..
..	..	..	..	..	..	.

MAY

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	..	..	..	..	..

JUNE

Su	Mo	Tu	W	Th	Fr	Sa
..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	..	..	..
..	..	..	..	..	..	..

JULY

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
..	..	..	..	..	..	..

AUGUST

Su	Mo	Tu	W	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..
..	..	..	..	..	..	..

SEPTEMBER

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	..	..
..	..	..	..	..	..	..

OCTOBER

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	..	..	..	..	..	..

NOVEMBER

Su	Mo	Tu	W	Th	Fr	Sa
..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	..	..	..	..
..	..	..	..	..	..	..

DECEMBER

Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	..
..	..	..	..	..	..	..

RECEIVED
NOV 25 1914
Division of Forestry
University of California

CALENDAR

1914

Sept. 28, Mon.	Academic Year begins in all departments of the University. Payment of the first instalment of the tuition fee is required on or before this date.
Oct. 12, Mon.	Columbus Day: a holiday.
Nov. 26, Thurs.	Thanksgiving Day: a holiday.

Recess from Dec. 23, 1914, to Jan. 2, 1915, inclusive.

1915

Feb. 1, Mon.	Second half-year begins.
Feb. 10, Wed.	The first term-bill is due on this date.
Feb. 22, Mon.	Washington's Birthday: a holiday.
Feb. 27, Sat.	Last day for re-engaging College Rooms for 1915–16.
April 2, Fri.	Last day for receiving applications for College Rooms for 1915–16.
April 9, Fri.	Last day for receiving graduation theses.

Recess from April 18 to April 24, inclusive.

May 29, Sat.	End of final examinations for first-year students.
May 31, Mon.	Memorial Day: a holiday.
June 5, Sat.	End of final examinations for second-year students.
June 23, Wed.	All dues of candidates for degrees must be paid on or before this date.
June 24, Thurs.	Commencement.

Summer Vacation, from Commencement Day to September 26, inclusive.

July 20, Tues.	Payment of the second term-bill is due on or before this date.
Sept. 27, Mon.	Academic Year begins in all departments of the University. Payment of the first instalment of the tuition fee is required on or before this date.

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

FACULTY

Abbott Lawrence Lowell, A.B., LL.B., LL.D., Ph.D., President.

Edwin Francis Gay, Ph.D., Dean, and *Professor of Economics.*

William Bliss Medlicott, S.B., *Lecturer on Fire Insurance.*

Herbert Beeman Dow, A.M., *Lecturer on Life Insurance.*

John Farwell Moors, A.M., *Lecturer on Investment.*

This Lectureship is maintained from the income of the Edmund Cogswell Converse Fund.

Edgar Judson Rich, A.M., LL.B., *Lecturer on the Theory and Practice of Rate-Making.*

William Morse Cole, A.M., *Associate Professor of Accounting.*

Oliver Mitchell Wentworth Sprague, Ph.D., *Edmund Cogswell Converse Professor of Banking and Finance.*

William James Cunningham, *Assistant Professor of Transportation.*

Arch Wilkinson Shaw, A.M., *Lecturer on Business Policy.*

This Lectureship is maintained from the income of the Isidor Straus Fund.

Lincoln Frederick Schaub, A.M., LL.B., *Professor of Commercial Law.*

Paul Terry Cherington, S.B., A.M., *Assistant Professor of Marketing.*

Selden Osgood Martin, Ph.D., *Assistant Professor of Marketing*, and *Director of the Bureau of Business Research.*

Frederic Gallup Coburn, S.M., *Lecturer on Factory Management.*

Charles Chester Lane, A.M., *Lecturer on Printing and Publishing.*

Clarence Bertrand Thompson, LL.B., A.M., *Lecturer on Manufacturing.*

John Matthew Gries, A.M., *Lecturer on Lumbering.*

Melvin Thomas Copeland, Ph.D., *Instructor in Marketing.*

Eliot Grinnell Mears, A.B., M.B.A., *Secretary*, and *Instructor in Public Utilities Operation.*

Walter Moreland Stone, A.B., *Superintendent of the Reading Room*, and *Assistant in Printing.*

The following gentlemen will take part in the instruction in Business Policy: —

Walter Horace Cottingham, President, The Sherwin-Williams Co., Cleveland.

Henry Sturgis Dennison, A.B., Treasurer, Dennison Manufacturing Company, South Framingham.

Paul Edward Fitzpatrick, A.B., Director, Brown, Durrell & Co., Boston.

John Silsbee Lawrence, A.B., Member of the firm of Lawrence & Co., Boston.

Herbert Warren Mason, A.B., Member of the firm of S. D. Warren & Co., Boston.

Elwyn Greeley Preston, Treasurer, S. S. Pierce Co., Boston.

John Roy Simpson, Vice President and Merchandise Manager, Wm. Filene's Sons Co., Boston.

The following gentlemen will take part in the instruction in Factory Management (first-year course): —

Carl George Lange Barth, Expert in Industrial Organization, Philadelphia.

Charles Day, S.B., M.E., Expert in Industrial Organization, Philadelphia.

Henry Sturgis Dennison, A.B., Treasurer, Dennison Manufacturing Company, South Framingham.

Henry L. Gantt, Expert in Industrial Organization, New York.

Charles B. Going, Ph.B., S.M., Editor of the *Engineering Magazine*, New York.

HORACE KING HATHAWAY, Vice-President and Manager, Tabor Manufacturing Company, Philadelphia.

EVERETT MORSS, S.B., President, Simplex Electrical Co., Boston.

WILLIAM EDWARD COFFIN NAZRO, S.B., B.A.S., of the Plymouth Cordage Co., North Plymouth.

WILLIAM LAWRENCE SAUNDERS, B.S., Sc.D., Chairman of the Board of Directors, Ingersoll-Rand Co., New York.

FREDERICK WINSLOW TAYLOR, M.E., Sc.D., Consulting Mechanical Engineer, Expert in Industrial Organization, Philadelphia.

The following gentlemen will take part in the instruction in The Taylor System of Management: —

ARTHUR EVERETT BARTER, General Superintendent, Plimpton Press, Norwood.

CARL GEORGE LANGE BARTH, Expert in Industrial Organization, Philadelphia.

HAROLD WEBSTER BROWN, Treasurer, Tabor Manufacturing Company, Philadelphia.

MORRIS LLEWELLYN COOKE, M.E., Expert in Industrial Organization, Philadelphia.

HORACE KING HATHAWAY, Vice-President and Manager, Tabor Manufacturing Company, Philadelphia.

SANFORD E. THOMPSON, S.B., Consulting Engineer, Newton Highlands.

The following gentlemen will take part in the instruction in Printing and Publishing: —

HERBERT LYNN BAKER, General Sales Manager of the C. B. Cottrell & Sons Co., New York.

ARTHUR EVERETT BARTER, General Superintendent, Plimpton Press, Norwood.

WILLIAM ADDISON DWIGGINS, Designer, Boston.

ALFRED W. ELSON, of A. W. Elson & Co., Boston.

ALBERT W. FINLAY, President and Manager of the George H. Ellis Co., Boston.

HARRIS B. HATCH, Treasurer and General Manager of the Royal Electrotype Co., Philadelphia.

AMOR HOLLINGSWORTH, A.B., of the firm of Tileston & Hollingsworth, Boston.

CHARLES CHESTER LANE, A.M., Director of the Harvard University Press.

ARTHUR DEHON LITTLE, Official Chemist of The American Paper and Pulp Association, Boston.

JOHN HORACE MCFARLAND, Secretary and Treasurer of the J. Horace McFarland Co., Harrisburg.

CHARLES SCHWEINLER, of the Charles Schweinler Press, New York.

DONALD SCOTT, A.B., New York.

DANIEL BERKELEY UPDIKE, A.M., the Merrymount Press, Boston.

The following gentlemen will take part in the instruction in Public Utilities Operation: —

MORRIS LLEWELLYN COOKE, M.E., Director of Public Works, Philadelphia.

HENRY LATHAM DOHERTY, Manager, Henry L. Doherty & Co., New York.

LOUIS D. GIBBS, A.B., Superintendent of Advertising, Edison Electric Light Co., Boston.

LUTHER ROBERTS NASH, S.M., Local Public Utilities Expert, Stone & Webster, Boston.

RUSSELL ROBB, S.B., member of the firm of Stone & Webster, Boston.

EDGAR NEWCOMB WRIGHTINGTON, A.B., 2nd Vice-President, Consolidated Gas Co., Boston.

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

1914–15

GENERAL STATEMENT

The Graduate School of Business Administration was established in March, 1908, by votes of the President and Fellows and of the Board of Overseers of Harvard College. The School was placed on an independent foundation with a separate Faculty by vote of the Governing Boards on June 19, 1913.

The School aims to give thorough and scientific instruction in the fundamental principles of business organization and administration, and to present such a range of elective courses that each student may receive the special preparation which is suitable to the requirements of the business career he purposes to enter. A broad foundation may thus be laid for intelligently directed activity in commerce or manufacturing, or in those specialized branches of modern business which now particularly call for professional training, such as accounting and auditing, railroading, banking, and insurance.

The School is strictly a graduate department of the University, and is therefore open only to students whose education and maturity fit them to undertake serious professional study. The requirement for admission as a regular student and candidate for the degree of Master in Business Administration is the possession of a bachelor's degree from an approved college or scientific school. Opportunities for special study are, however, open to students not candidates for a degree.

ACADEMIC YEAR

The academic year 1914–15 will begin on Monday, September 28, 1914, and work in the School will close with the final examinations, ending for first-year students on May 29, 1915, and for second-year students on June 5, 1915. There will be a recess from December 23, 1914, to January 2, 1915, both inclusive; and also from April 18 to April 24, both inclusive.

The work in classes will begin on Tuesday, September 29, 1914.

ADMISSION OF STUDENTS

Graduates of approved colleges or scientific schools are admitted without examination as regular students and candidates for the degree of Master in Business Administration.

Undergraduates of Harvard College who have completed the requirements for the degree of Bachelor of Arts or of Science, but have not received the degree, may be admitted to the Graduate School of Business Administration. Those who lack not more than a single course of the requirements may be admitted to the School if in the judgment of the Dean they are likely to prosecute satisfactorily the work of the first year in the School. Such men constitute the group of unclassified students and their entire work must be carried on under the supervision of the School.

Ordinarily only students who enter at the beginning of the academic year will be permitted to take the program of study open to regular students.

Persons of suitable age and business experience not graduates of an approved college or scientific school are admitted to any course as special students upon obtaining the permission of the Faculty. Such students are not candidates for a degree; but they may be given a certificate on completing satisfactorily the work of the course or courses to which they are admitted. As a rule such students will be permitted to take not more than a total of two courses, whether in the same year or in successive years.

REGISTRATION

Every student in the School and every applicant for admission is expected to be present in Cambridge at the beginning of each year of his membership in the School, and to register on Monday, the first day of the academic year, by filling a registration blank and filing it at the office of the School, or at such other place as may be designated by notice posted in University Hall. A student who enters on his studies after the beginning of the academic year must upon entrance register at the office of the School.

On registering, a student receives a certificate of registration from the officer in charge; this certificate he must present to the Bursar, when he files his bond or gives other satisfactory security for the payment of his dues for the year, and he will obtain from the Bursar authorization to attend instruction and to use the College Library. In case the registration is afterwards not accepted, it will be cancelled, and the student will not be liable for tuition fees; or he may be transferred to another department of the University.

A student is counted as a member of the School only from the date of his registration, and during the period when he is actually engaged in his studies as a student in the School.

A student who withdraws from the School in the course of an academic year is required to give immediate written notice at the office of the School. No deduction from the full year's fees will be made in the case of a student who withdraws during the year unless he gives this notice.

At registration, or within two days thereafter, every student of the School is required to submit to the Dean his list of elective studies for approval and then to file this list, countersigned by the Dean, at the office of the School. Any subsequent change in this list of studies must be similarly approved and filed.

REQUIREMENTS FOR THE DEGREE

The degree of Master in Business Administration is granted on the satisfactory completion of an approved program of study, normally requiring two years of residence. A longer period of residence and study may be necessary for students whose preparation has been inadequate.

A complete year's work ordinarily consists of four full courses of advanced grade, pursued throughout the academic year, or of equivalent work, whether done in connection with any course or courses of instruction or carried on outside of the courses, provided that the weight it is designed to have in the year's program is approved by the Faculty.

Each second-year student is required to submit a thesis dealing with some concrete problem in the business which he plans to enter and embodying the results and conclusions derived from his original investigation of actual business conditions. A statement giving the subject of his thesis, and an approval thereof in writing by some member of the staff of instructors in the School, must be filed with the Dean before December 1, and the completed thesis must be presented to the Dean before April 10.

Students who complete the program of study with distinguished excellence will receive the degree of Master in Business Administration with Distinction.

RECOMMENDATIONS AS TO PREPARATORY STUDIES

Though a bachelor's degree will ordinarily admit the student to regular standing, it is recommended that he pursue during the latter part of his college career certain studies which will be useful to him in preparing for the more highly specialized work of the Graduate School of Business Administration. Such studies are usually offered in any good college or scientific school. If the student's preparation is found inadequate, he may complete it after entrance; and it is advisable for him to consult with the Dean as soon as possible in regard to the manner in which such deficiencies are to be made good.

Among the courses offered by the Department of Economics in Harvard College those on the industrial and financial phenomena of modern times are of service to students who purpose to enter the School. Such are the courses on Principles of Economics (*A*), Money and Banking (3), Economics of Transportation (4*a*), Problems of Labor (6*a*), Economics of Corporations (4*b*), Taxation (5), the Economic and Financial History of the United States (2*b*), European Industry and Commerce in the Nineteenth Century (2*a*), Statistics (13), and Physiography, elementary course (Geography 1).

A command of good English and a reading knowledge of at least one modern language, either German or French, are expected. Proficiency in German, French, and Spanish is desirable. Some knowledge of mechanical drawing is highly useful in almost all branches of business.

The training in exact observation and the specific knowledge acquired in mathematics and in such scientific studies as physics and chemistry are of no less importance in many lines of business administration. An administrative officer engaged in the business of manufacturing, transportation, or insurance, can effectively grasp many essential parts of his business only through a knowledge of the mechanical, chemical, or physical phenomena and laws involved. A thorough knowledge of mathematics, including calculus, is of profit to any serious student, and is, indeed, essential in certain professions, such as that of the actuary.

But while it is strongly recommended that preparation for the work of the School and for the later business career should include the subjects here indicated, attention is called to the fact that one of the chief objects of requiring a bachelor's degree for admission to the Graduate School of Business Administration is that the strictly professional work of the School may rest upon a foundation of liberal studies. A due proportion of the preparatory college course should, therefore, be given to studies having a general value for education and culture.

PROGRAM OF INSTRUCTION

Since the aim of the School is to give to each individual student a practical and specialized professional training suitable to the particular business which he plans to enter, freedom of election is provided for a part of the courses of the first year and for all the courses of the second year. The courses selected by the student should be chosen in accordance with a definite plan. Each student before enrolling in an elective course must submit to the Dean for approval the list of studies he desires to pursue.

All students regularly admitted as candidates for the degree are ordinarily required in the first year of the two years' program of study to take the following three courses: —

Accounting Principles.
Commercial Contracts.
Marketing (first-year course).

Ability to write English clearly and concisely is of such importance to a business man that provision is made for instruction to correct deficiencies in the English training of students entering the School. All papers and reports written by students in Marketing (first-year course) are read and criticised constructively not only by the instructor in the course but also by an instructor in English. Satisfactory completion of the course is conditional upon attaining the required proficiency in English. In other courses defectively written reports are also referred to the English instructor.

The classification of courses in groups is not intended to limit the lines of study within which a student preparing for a special field should work. Experience has shown that the student specializing in one field has an adequate preparation for the work in that field only when he has studied other subjects which on a superficial view seem unrelated but are in reality closely linked to his specialty. As an illustration of a program of studies, on page 56 will be found a suggestion of courses for students in Lumbering.

In the first year the courses ordinarily selected by students and recommended by the Faculty consist of the three required courses above mentioned and an introductory course in the group in which the student wishes to specialize during his second year. In many cases first-year students find it desirable, especially when the introductory course is one of the required courses, to take in addition Business Statistics or Factory Management (first-year course) in the first half-year and Investments during the second half-year.

Since the courses offered in the School are all of advanced grade, and since uniformly serious work is expected of students, a student is not usually permitted to take more than five full courses each year. Students whose work is at any time unsatisfactory will be notified and, if no improvement is evident thereafter, will be requested to leave the School.

In order to secure as much time as possible for the actual work in the School, classes are continued throughout the year with an interruption of only three days at the usual mid-year examination period.

In the courses on Commercial Law the case-system is used. In the other courses, an analogous method, emphasizing class-room discussion in connection with lectures and frequent reports on assigned topics, — what may be called the "problem-method," — is employed as far as practicable. Although the material for these problems and reports is often drawn from the records and experience of large corporations, which have developed the most advanced methods and publish the most comprehensive reports, the training acquired is equally serviceable for men who are to be employed by smaller concerns or who hope to establish themselves independently.

Visits of inspection are made under competent guidance to various commercial and manufacturing establishments in

Boston and in the neighboring manufacturing centres of New England. Similar field work of a more specialized character forms a feature of the advanced work of the second year. Advisory Committees of leading business men in a number of industries coöperate with the staff of the School in guiding the work, especially of second-year students.

None of the courses here offered can be counted towards the degree of A.B. or S.B.

For further information or for copies of this pamphlet or of the examination papers set in this School application should be made to the Secretary of the Graduate School of Business Administration, 17 University Hall, Cambridge, Massachusetts.

RECEIVED
NOV 25 1914
Division of Forestry
University of California

DESCRIPTION OF COURSES

ACCOUNTING

In the last twenty years the business world has come to see new value and new uses in accounts; and accountants have realized the necessity of constructing accounts so that they shall tell the operating manager what he needs to know about his business. Indeed, it may now be said that no business is conducted successfully, or can be long so conducted, unless someone is constantly analyzing that business and presenting the result of that analysis in a clear statement. Such analysis and statement is the accountant's task; and it is a very different task from that of the book-keeper. The person who is a mere book-keeper records known facts; the accountant, by scientific analysis, learns the facts to be recorded, or directs the book-keeper in recording the known facts in such fashion that the unknown facts may be learned.

For purposes of general training the introductory course Accounting Principles ordinarily will be sufficient, but students who desire further training should take in addition during their first year Accounting Practice. The half-course Industrial Accounting is designed to meet the needs of students in a variety of specialized lines, such as Manufacturing, Lumbering, and Printing. For those planning to enter the profession of accountancy, Accounting Principles and Accounting Practice are required in the first year as preparation for the advanced work in Accounting Problems and Industrial Accounting in the second year. Students doing satisfactory work in the courses in accounting should without difficulty pass the examinations for the C.P.A. certificate.

Accounting Principles

Associate Professor Cole. Mon., Wed., and (at the pleasure of the instructor) Fri., at 11.

The purpose of this course is to indicate the fundamental and universal principles that accountants must use in their work. These are important for the manager who wishes either to direct his bookkeepers or to profit fully by the work of his accountants. Since, however, anyone who does not fully understand book-keeping terms and methods is in danger of misinterpreting accounting statements, because he does not appreciate the facts behind the figures, an examination of certain main types of book-keeping, with abundant practice in their use, forms a part of the year's work. The rest of the work is devoted to the study not only of fundamental principles — such as the distinction between capital and revenue, the nature of maintenance and depreciation, the methods of sinking funds, the effect of interest on valuations, the basis of cost accounting, — but of the practical application of these principles to the enterprises in which they are most conspicuous, and of the accounting peculiarities of businesses of universal interest, such as banking, insurance, transportation, and investment.

The course is prescribed for all candidates for the degree of Master in Business Administration.

Accounting Practice

Associate Professor Cole. Half-course (second half-year). Mon., Wed., and (at the pleasure of the instructor) Fri., at 10.

This course is intended to follow (or to parallel), in concrete and practical form, the work of the introductory course in the principles of accounting. Detailed practice in the making of entries for concrete transactions in books of account that are highly developed and therefore illustrate advanced book-keeping practice serves to give the student facility in the handling of common accounts. A study is then undertaken of the accounting methods in use for varying financial relations and for varying types of enterprise. Many of these involve technical knowledge of business customs and laws which, since they are not of universal application in ordinary business, are not considered in Accounting Principles. Illustrations of these are partnership settlements, administration of estates, and bankruptcy proceedings. Other subjects, introduced in Accounting Principles, are further developed in this course, — banking accounts, for instance. Students preparing for a career in accountancy are expected to take this course. It is open only to students who have taken or are taking Accounting Principles.

Industrial Accounting

Associate Professor Cole. Half-course (first half-year). Mon., Wed., and (at the pleasure of the instructor) Fri., at 10.

Proper accounting for productive enterprises requires something more than the determination of costs. The accounts should show criteria not only for judging the effectiveness of labor and of materials and for determining the amounts and causes of waste, but also for establishing certain standards of both accomplishment and cost. This course continues the study of cost accounting begun in Accounting Principles, and examines in fuller detail the common methods of ascertaining both prime costs and burden costs, and the common methods of distributing the latter over various products. It then passes to the choice of methods, and the application of the chosen methods, for particular types of industrial enterprise. It next studies for a few typical industries the accounting records necessary for adequate check on effectiveness of materials and of labor, and for the determination of standards. Attention will be given also to the content and form of operating reports for the guidance of various responsible officials and superintendents. Some attention will be given to methods or devices for calculation, such as logarithms and the slide rule.

The course is open only to students who have taken Accounting Principles.

Accounting Problems

Associate Professor Cole. Mon., Wed., and (at the pleasure of the instructor) Fri., at 12.

Analytical power, breadth of view, initiative, and resourcefulness, with regard to accountancy, are cultivated in this course. The problems considered are chosen almost wholly from fields where no legal prescription or formal traditional program of procedure can direct the student in his work. He is forced to fall back on his knowledge of principles, his knowledge of business practice, his power of analysis, and his native judgment. The problems considered during any year are determined in part by the general needs of the students, and in part by the expected special lines which students are likely to follow after graduation.

LAW

Business practice is so closely related with law and so conditioned by it at every point that it is advisable and even necessary that students of business have some acquaintance with this essential feature of their environment. They do not need to have a knowledge of legal procedure and the other matters which have been termed the machinery of the law. Nor need they be especially concerned with those subjects of the law that have no bearing on business transactions. On the other hand, however, their adequate equipment for business requires them to have a working knowledge of those rules of law that have frequent and direct applications to the conduct of business.

It is the constant effort in this School to give this instruction in the law so thoroughly and intensively that practical benefit may be secured therefrom by the future business man. It is believed that an introduction of this kind to the law will enable him from the start to escape the obvious pitfalls in everyday business. It is furthermore true that instruction which does not seek to circumvent the complexities of the subject will spare him the necessity of learning from hard experience how desirable it is, especially in unfamiliar situations, to seek capable legal advice before as well as after events. Moreover, whenever it will be necessary, he will be in a position to work with lawyers intelligently. In addition, his own special work will grow more interesting by observing the interaction of law and business on each other, and by comparing the requirements of the law with the other external standards by which conduct is regulated, such as general custom, sound business practice, and the prevailing ideals of honorable business men.

The student certainly will be benefited by the power which is developed by a proper legal training. The ability to analyze and to discriminate and to state clearly and concisely the facts of a complicated business situation is needed by the business man as much as by the lawyer. Class-room discussion of cases involving the rules by which the law regulates the conduct of daily life is now very generally recognized as a method of almost unique serviceableness for the attainment of this kind of useful power. The case system of instruction is, therefore, the method that is employed in all the law courses offered in this School. It is the policy, however, to eliminate cases of purely historical interest in the development of a doctrine of law; nearly all of the cases selected for study are comparatively recent decisions, and of interest because of the business problems involved, as well as because of their discussions of rules of law.

Commercial Contracts

Professor Schaub. Tu., Th., Sat., at 10.

Modern business is necessarily founded on the power of enforcing the fulfilment of commercial undertakings. Hence in this introductory course to the law, the principal aim is to develop the principles of the law of contract, emphasis being laid upon their practical application in many varieties of business dealings. These principles are discussed from the point of view of determining to what extent the law makes itself the instrument of the intentions of the parties and to what extent other elements are essential to legal liability.

The course deals principally with the legal requisites for the formation, assignment, performance, and discharge of business contracts. In addition to bargains which are made informally, it includes those which are embodied in instruments, whether they be sealed instruments, negotiable instruments, or instruments neither negotiable nor sealed. Attention is also given to the special rules relating to suretyship obligations, and to those liabilities which are peculiar to public service companies.

The latter part of the course treats of the transfer of property, especially personal property, both by way of sale and by way of security for a debt. Finally, a brief study is made of trading methods that are unlawful or of doubtful legality either because of public policy, or because they infringe on the rights of one of the parties to the bargain, or because they injure the business good-will belonging to another. Throughout the course students are given opportunities to familiarize themselves with the forms of the most common commercial documents.

The course is fundamental in the study of commercial law and is required of all candidates for the degree.

Law relating to Business Associations

Professor SCHAUB. Tu., Th., Sat., at 12.

One of the most striking developments of modern business is the growth of large-scale operations. In many lines of business today it is practically necessary in order to secure a profitable business unit to associate together for that purpose the managerial abilities and the capital contributions of a group of individuals. It is the design of this course to study in detail those rules of law which relate to the activities of such organizations.

It is indispensable to the study of action by groups of men for a common purpose to know the law relating to representative action. Hence, first of all, in this course a careful study is made of the principal topics of the law of agency, including the important state and federal legislation on labor matters.

The main work of the year consists of a detailed comparison with each other of the various kinds of business associations, particularly partnerships and corporations. Among the subjects discussed are the formation of such associations; the property of the association and the interest of the associates therein; the separate property of the associates, as affected by their admission into the association; modes of action by the association; the effect as between the parties to the transaction of unauthorized action on behalf of the association; the position of promoters, officers, and a majority of the associates.

The course closes with a consideration of legal problems resulting from the modern business tendency toward concentration, such as intercorporate relations, holding corporations, consolidation of corporations, and recent interpretation of the Sherman Anti-Trust Act.

This course is open only to students who have passed satisfactorily in Commercial Contracts, or can otherwise satisfy the instructor of their fitness.

Law relating to Banking Operations

Professor SCHAUB. Half-course (first half-year). Mon., Wed., Fri., at 10.

Those principles of law which govern the more usual transactions in the commercial banking business are dealt with in this course. The first part of the course consists of a study of the law relating to negotiable instruments, considering in detail the requirements of the Negotiable Instruments Law as to their formal requisites; their transfer; the formalities which are conditions precedent to a right of action upon such instruments; and the real and personal defenses available against the holder.

The latter half of the course is devoted to the law of banking operations proper. It includes the discussion of such questions as the nature of a depositor's contract; rights and liabilities of the bank in making collections: payment of checks; and loans and the various kinds of securities therefor.

This course is open only to students who have passed satisfactorily in Commercial Contracts, or can otherwise satisfy the instructor of their fitness.

Law relating to Railroad Rate-Making

Mr. RICH. Half-course (second half-year). Tu., 4.30–6.

Advanced problems and special research in lego-traffic matters are taken up in this course. A study is made of the reasonableness of a schedule of rates as a whole, with especial reference to physical valuation. The methods employed by the Interstate Commerce Commission in making physical valuation are discussed. Especial attention is given to the elements which should be added to the value of the physical property in order to arrive at a fair value of the railroad.

The course is only for students intending to enter the traffic or legal department of a railroad, who have already taken Commercial Contracts and Railroad Rate-making.

Those who have passed satisfactorily in Commercial Contracts will be considered as qualified to take the following courses in the Law School:

ADMIRALTY. Mr. DUTCH.

INSURANCE. Professor WAMBAUGH.

PUBLIC SERVICE COMPANIES: especially Common Carriers. Professor FRANKFURTER.

MARKETING

Buying and selling merchandise have always presented difficult problems. But they are now more than ever complicated and disturbed by recent attempts to adjust methods of distribution to new conditions of production and consumption. Although this holds true of the markets for both raw materials and finished products, it is in connection with the latter that the questions of most vital interest and importance have arisen. The position of the commission house and wholesaler in certain lines has been modified, particularly by new policies of manufacturers and by new conditions in the retail field. Department stores, chain stores, mail-order houses, and other retail institutions of comparatively recent development have intensified competition. New consumer conditions have arisen. Advertising has rapidly expanded and other means for stimulating and controlling trade have been devised.

From this confusion in the merchandising field there have emerged numerous problems, not yet solved. In dealing with these questions the merchant or manufacturer needs a wide knowledge of business conditions and methods. And the banker, for instance, in granting credit and buying commercial paper is constantly confronted with marketing problems. A railroad company in selling its services has to give weight to commercial considerations. It is because of its fundamental importance that the subject of marketing is given a central position in the work of the School.

Marketing (*First-year course*)

Asst. Professor CHERINGTON and Dr. COPELAND. Mon., Wed., Fri., at 9.

Prevalent commercial methods and typical marketing problems in the domestic trade of the United States are studied in this first-year course. Although detailed in themselves, the questions discussed are in the main of common occurrence. In the later courses, for which this course provides the basis, more narrowly specialized but broadly interrelated problems are taken up.

An analysis is made of the buying and selling methods for raw materials and finished products in several American industries, each of which is selected to illustrate some particular type of commercial organization. The services rendered by each participant in the assembling and handling of raw materials, the operation and functions of produce exchanges, the commercial significance of the size and location of plants, and, finally, the agencies whereby the products are distributed are the chief points covered in these analyses. The reasons for the methods used in each trade are sought, and the methods in different trades are contrasted. This leads to the subject of wholesale and retail distribution, to which the second half of the course is devoted.

How do the new forms of distribution differ from the so-called regular methods of marketing? Why have these new forms developed? Wherein lie their advantages for carrying on particular trades and what are their weaknesses? How is this competition being met? How have manufacturers been affected and how have they modified their selling policies? Specific cases involving such questions as these and referring also to problems of betterment of sales efficiency, brand control, dealer coöperation, choice of advertising mediums, and other selling and advertising problems are discussed.

Instruction in English is an integral part of this course. The reports, made frequently, are all examined by the English instructor for criticism and suggestions. This course is required of all candidates for the degree.

Marketing (Second-year course)

Asst. Professor Cherington. Hours to be arranged.

To students who have satisfactorily completed Marketing (first-year course), an opportunity is offered in this course to investigate problems in marketing organization and methods. Since individual guidance is given, the choice of subject for study must be determined largely by the student's interest and aptitude. An indication, however, of the type of subject may be obtained from the following topics which have been assigned for investigation during the current year: the marketing of textiles under trade marks, methods of meeting mail-order competition in a town in western New York, comparative prices in department store advertising, ten years' changes in the lumber trade of Boston, delivery systems of Chicago mail-order houses.

Since this course necessarily takes the form of field work, special attention is given in class discussion to the best sources and methods for securing first-hand knowledge of marketing conditions.

INDUSTRIAL MANAGEMENT

Industrial management is the organizing and directing of men and materials in the production of goods and services. The factory system opened the way to large economies of production through its massing of workers in disciplined organization and its new possibilities of standardization and specialization reinforced by mechanical power and machinery.

Manufacturing problems have had more scientific attention than marketing problems. For many years they have received careful study from engineers, factory superintendents, and heads of business enterprises. It is, therefore, less difficult to find material for the scientific study of modern business in the field of production than in that of market distribution.

The modern factory is the typical illustration of the application of industrial management, but the principles of industrial management extend beyond manufacturing plants into mercantile establishments, transportation, local public utilities, lumbering, and wherever industrial conditions of grouped laborers exist.

In the introductory course in factory management the general principles underlying sound industrial management are studied and, though the factory naturally furnishes the field of observation, the survey is of high value not merely to those who plan to specialize in factory management but also to all students of business. The second-year courses afford opportunities for detailed study of modern systems of management and for specialized training to men who look forward to a career in manufacturing.

Factory Management (First-year course)

Asst. Professor MARTIN, Mr. MEARS, and the following lecturers: Messrs. C. G. L. BARTH, F. G. COBURN, C. DAY, H. S. DENNISON, H. L. GANTT, E. F. GAY, C. B. GOING, H. K. HATHAWAY, E. MORSS, W. E. C. NAZRO, W. L. SAUNDERS, F. W. TAYLOR, and C. B. THOMPSON. Half-course (first half-year). Wed., Fri., and (at the pleasure of the instructor) Mon., 4.30–6.

Concentration of workers, standardization, specialization, mechanical improvement, all inter-related and inter-acting, have in their later development produced a series of complex factory problems, both mechanical and managerial. The organization, methods, and management of the modern factory are the subject-matter of this course. Organization is not a chart or a mould but a flexible structure. It varies according to the main purposes for which it exists, whether to save time or to save money, whether to provide volume of product or to provide variety and quality. It is not a machine but a living group, in which team play is essential to efficiency.

External problems such as location and type of construction and internal problems such as materials, routing, power, equipment, and cost accounting are considered. Much attention is given to problems of labor, such as employment, training of employees, and methods of compensation. Just and human relations between employer and employed, which business heads are now regarding as most vital, are emphasized.

Special stress is laid upon inspections by the students, under careful and detailed direction, of well-organized factories and upon written reports based upon these inspections. Class-room discussion and criticism of these reports form an important part of the instruction.

The lecturers, selected for their specialized knowledge and experience in their subjects, coöperate to make their lectures and concrete illustrations of modern practice fit specifically into the plan of the course. Though many of these illustrations are of necessity drawn from large businesses, much of the course is designed for small and medium-sized businesses.

To take this course, previous factory experience or technical training is not necessary.

Factory Management (Second-year course)

Mr. COBURN. Hours to be arranged.

Such subjects as the management of plant, machinery, tools, and stores, organization plans, administrative methods, and the control of labor, material and expense items of production are studied in different types of industrial establishments. Each week students are assigned topics for study in a particular plant and are given practical suggestions directing attention to the problems which have to be considered by the factory manager. Emphasis is placed upon the professional character of the reports, and training is given in presenting information and in summarizing facts and statistics in logical order for executive action.

This course will be counted as a half course or a whole course according to the amount of work done.

The Taylor System of Management

Mr. C. B. THOMPSON, and the following lecturers: Messrs. A. E. BARTER, C. G. L. BARTH, H. W. BROWN, M. L. COOKE, H. K. HATHAWAY, F. W. TAYLOR, and S. E. THOMPSON. Hours to be arranged.

The recent developments in factory administration, known popularly as "scientific management," first took definite form in the work of Mr. Frederick W. Taylor of Philadelphia and his group of assistants. The Taylor System is today the most complete and consistent example of recent tendencies. In appearance it is radically different from current methods but is in fact logically developed from them.

This course lays stress mainly on the present practical application and methods of the Taylor System, basing the discussion upon the development from current methods and the history and literature of the system itself. The lectures, all of which are given by men actively engaged in the application of the Taylor System, and the reading, carefully selected from the considerable literature on the subject, are accompanied by practical work in classification, standardization, maintenance of store-rooms and tool-rooms, routing, time study, and the preparation of instruction cards. The laboratory work is done in the Harvard University Press, in the machine, wood-working, and blacksmith shops of the Rindge Technical School, and in manufacturing plants in Boston and vicinity. The students are required to install and carry on such parts of the system as it is practicable for them to apply.

Attention is called to the following courses offered by the Faculty of Arts and Sciences: —

Engineering Sciences 11 ^{1}*hf.* Power Generation and Transmission. Professor Marks, Mr. Markham, and an assistant.

Engineering Sciences 16. Generation, Transmission, and Utilization of Electrical Energy. Professor Kennelly and Mr. Crane.

GENERAL BUSINESS PROBLEMS

The problems of production, marketing, and business administration are interdependent and converge upon the general management for final consideration and decision. In determining a sales policy, for example, it is necessary to take into account the factory operating conditions, the credit and financial situation, and other factors. The interdependence and convergence of these factors are emphasized by their correlation in the courses of this group.

The course Business Statistics studies the technical means whereby department heads and the general management may obtain from all departments of a business statistical information needed for the formulation of their policies.

The actual formulation of these policies in the light of this statistical information and other facts available, including general business considerations, is discussed from the point of view of the management in the course Business Policy. Possible solutions of specific business problems are considered in accordance with the uniform maintenance of the relations established by the management in applying the principle of balance between cost, quality, and service in manufacturing and marketing, and between speed, accuracy, and expense in administration.

Business Statistics

Dr. Copeland. Half-course (first half-year). Tu., Th., Sat., at 9.

Business management depends for its success upon a careful analysis of facts; and many of these facts can best be presented in statistical form. These statistics are at some points closely allied with accounting and cost determination, but they are used as distinctly different means of testing efficiency, detecting waste, and furnishing a guide for future plans. In practically every kind of business and by establishments of all sizes, properly selected statistics can be advantageously utilized. Opportunity is offered in this course for studying the principles which are to be observed in collecting, presenting, and interpreting statistics for business purposes. The work is closely correlated, without duplication, with that in many other courses in the School.

The application of sound statistical theory and practice to actual business problems is the object sought. A critical examination is made of systems of forecasting business conditions and of the commercial, industrial, and financial statistics of which they make use. Along with this subject and immediately subsequent to its conclusion, the leading principles of theory and method, which form the ground-work for the whole course, are outlined. Attention is then turned to the application of statistics to specific commercial and manufacturing problems. How is the capacity of a prospective market to be estimated ? Is the volume of trade in present markets showing proper expansion ? What sales records and what stock records are needed by the manufacturer, the wholesaler, and the retailer ? What statistics can the advertising manager use for selecting mediums and checking up results ? What purchasing records are to be kept, and how is it to be determined whether or not purchases are being made at the most opportune times ? What use is to be made of the reports of current operations in the factory ? Finally, which of these statistics ought to be presented to the chief executive and in what form ? Such questions as these are discussed, using specific examples drawn from different lines of trade and for establishments of various sizes.

Another feature of the work is the investigation by students of the growth and conditions of business in individual cities. The method of investigation is widely applicable and is essentially the same, whether in the interest of a chamber of commerce, a public service company, an investor, or of a manufacturer selecting a location for a plant or branch establishment.

The preparation of reports and charts gives essential practice in collecting and handling statistics and a knowledge of common abuses and errors to avoid.

Business Policy

Mr. A. W. SHAW and Asst. Professor MARTIN, and the following lecturers; Messrs. W. H. COTTINGHAM, H. S. DENNISON, P. E. FITZPATRICK, J. S. LAWRENCE, H. W. MASON, E. G. PRESTON, and J. R. SIMPSON. Mon., Wed., Fri., at 9.

The dominant purpose of this course is to give second-year men an opportunity to focus upon actual business problems the knowledge already gained in the School and from their summer employment. A view of business is given from the angle of the general manager.

An analysis of any business problem shows not only its relation to other problems in the same group, but also the intimate connection of groups. For example, not only is any problem of factory management related to other problems in the factory, and any problem of selling related to other problems in the sales department, but also these groups of problems are interdependent. No problem in business is purely intradepartmental. Furthermore, within each department there must be preserved a uniform principle of balance. In preserving this balance, it is necessary for the management to maintain a certain detached position where neither personal bias nor immersion in detail will affect the policy laid down. Finally, in analyzing the problem, a definite and ordered method of approach is set up. It is in directing and exercising the student's mind toward habitual use of this approach that the chief value of the course lies.

The instruction is by lectures, a text-book, and the study of actual problems which business men have considered and the policies which dictated their decisions in each case.

Following the proposal and the discussion of these problems, each member of the class makes a brief oral report to the class upon the results of his research work in the subject assigned to him. After this oral report, and after the points raised in class during their discussion have been further investigated, a written summary is submitted to accompany the business data gathered. In the second half-year begin the outside lectures by business men. Each lecturer takes charge of the class for a week or a fortnight. These lecturers have aided in developing the course, and plan their work to fit into the general scheme. They coöperate to make the course practical and dynamic by describing actual problems from their own desks, and by analyzing and discussing written solutions, presented by the class, for meeting these problems.

In the second half-year, students who have done a certain quality of work are assigned to advisers conversant with the subjects in which the students are specializing. The advisers are outside lecturers and other business men in Boston and vicinity, each of whom has agreed to give a minimum of half an hour a week to one student of this course. With the consent of the instructor this course may be taken during the first half-year as a half-course.

FOREIGN TRADE

Our great and constantly increasing foreign trade involves many difficult problems, the solution of which requires familiarity with business conditions in foreign countries as well as in our own and with international trading methods. In the import trade direct foreign purchasing by manufacturers, import houses, and department stores, for example, calls for a wider knowledge of the sources whence the goods are to be obtained, of the agencies by which the trade is carried on, and of other features of the commercial mechanism than was the case when the trade was handled more largely by commission houses.

As yet American manufacturers and merchants, with a few exceptions, have not put forth the serious and consistent efforts necessary for building up an export trade in manufactured goods. They are discovering, however, that foreign markets for such products cannot be secured by following the policies of the exporters of raw materials. Manufactured wares must not only be offered for sale; they must be pushed and pushed intelligently with due reference to distributing methods and consumer demand. Merchandising methods are, in some lines, quite different in the United States and foreign countries.

Both import and export trades are studied in these courses. But the greater emphasis is laid on means of placing goods in foreign markets, the competition which is likely to be encountered, the probable demand for typical products, and how these products are actually to be distributed to the foreign consumers. Opportunities for capital investment in foreign countries are also considered. The courses are informative in that they describe the geographical, social, and industrial conditions which form the essential background of international commerce. They are analytical in their search for the reasons why particular methods are used and why particular developments are taking place in individual typical trades. The analogies and contrasts with the merchandising methods in the domestic trade of the United States make such study profitable even to students who do not plan to enter the import or export trade.

Foreign Trade Methods

Asst. Professor CHERINGTON. Half-course (first half-year). Mon., Wed., Fri., at 1.30.

The central question in this course is, how is American foreign trade carried on? In import trade, for instance, the ground covered includes such matters as the selection of sources, establishment of connections, internal organization, and market development; and in the export trade, market selection, exporting method selection, price policy, relations with commission houses and agents, and problems of order execution, such as packing, shipping, insurance, forwarding, exchange, credits and collections.

European Trade

Dr. COPELAND. Half-course (second-half-year). Tu., Th., Sat., at 9.

About one-half of the total quantity of merchandise annually imported into the United States comes from Europe. To Europe an even greater proportion of our total exports is sent. And this trade is constantly expanding. European manufacturers are also our chief competitors in neutral markets. This indicates the relative importance of a study of European trade.

After a brief introductory survey of the general geographical, political, and social conditions which influence trade in the chief European countries, analyses are made of the commercial methods in typical industries. Thus the characteristics of the domestic markets and of the import and export trades in raw material and manufactured products are brought out. The following are samples of questions discussed: What is the commercial significance of the high degree of localization and specialization of the English cotton mills? How is it that the English cotton industry, importing all of its raw material and exporting over 80 per cent of its products, maintains its preëminent leadership? What is the place of the London wool auctions in the world's wool trade? Why has so much small scale production persisted in the manufacture of shoes in Continental countries and how does this affect the market for American shoes? What are the reasons for the relatively high development of the steel and chemical industries in Germany and how have the cartels modified marketing methods? How is the import trade in American wheat and flour handled in these European countries? What have been the effects of the German Exchange Law on the grain and sugar trades? How has the development of department stores, chain stores, and coöperative societies affected wholesale and retail methods in Europe? Wherein lies the strength of the German export trade organization? The concluding section of the course takes up tariff, patent, and trademark regulations and foreign credit methods.

Although ample opportunity will be offered for reading French and German, and a reading knowledge of these languages is strongly recommended, none of the required work will necessitate the use of these languages.

Latin-American Trade

Asst. Professor Martin. Half-course (second half-year).

Omitted in 1914–15; to be given in 1915–16.

The establishment and development of this course is a part of the marked increase of interest in Latin America in the last ten years.

The foreign trade of the United States is increasing rapidly, but it is increasing with Latin America more rapidly than with any other part of the world. With the opening of the Panama Canal, a new impetus to this trade and the development of new relations of all kinds between the United States and a large part of Latin America is expected.

This course deals with the economic resources of the various countries, and with their resulting trade, trade problems, and trade possibilities. The West Indies, Mexico, and Central America are considered briefly. South America is studied in greater detail. General problems, such as currency, banking and exchange, capital investment, credits, shipping, transportation, trade analysis, and trade organization, are taken up for the whole field. In South America the countries within the geographic groups, North Coast, West Coast, and East Coast, are taken up country by country more intensively in connection with these and allied subjects.

A reading knowledge of Spanish is advisable, but not required.

Attention is called to the following courses offered by the Faculty of Arts and Sciences: —

HISTORY 56b ²*hf*. History of Latin America. Professor DE OLIVEIRA LIMA.

FRENCH 3. French Composition (elementary course). Mr. RAICHE.

FRENCH 4 ¹*hf*. French Composition (intermediate course). Mr. MERCIER.

FRENCH 5 ²*hf*. French Composition (advanced course). Mr. MERCIER.

SPANISH 7 *hf*. Spanish Composition (elementary course). Dr. WHITTEM.

GERMAN *H* ²*hf*. Practice in Speaking and Writing German (second course). Dr. SCHOENEMANN.

GERMAN 18 ¹*hf*. German Grammar and Practice in Writing German (advanced course). Associate Professor BIERWIRTH.

BANKING AND FINANCE

The organization and operation of banking and other financial institutions and the financial policy of corporations form the subject-matter of the courses included in this group. Experience alone can give facility in the details of routine work; but these courses will be found useful in enabling the student who has followed them to see beyond the limits imposed by the minute division of routine labor in large banks or by departmental organization. The student will secure knowledge which should make his future work more interesting to himself at the outset and in no long time more effective through the exercise of trained observation upon the particular task which he performs and upon its relation to the other work going on around him.

It is the chief purpose to offer a training to men who plan to enter the business of commercial or investment banking but since it is sought to provide the basis for the formation of sound and conservative judgment regarding financial matters, some one or more of the courses may often advantageously form part of the plan of study for other students whose primary interest is in a different kind of business.

Banking

Professor SPRAGUE. Tu., Th., and (at the pleasure of the instructor) Sat., at 11.

Subjects which are common to all banks, including organization, the duties of the various officers, and an analysis of each item of banking resources and liabilities, are first studied. The history and working of the English banking system is examined in considerable detail, followed by a more general survey of banking in France and Germany. In connection with this part of the course each student prepares a statistical and descriptive report upon the London money market during a period of moderate financial strain, based upon data collected from financial journals and other sources of current information.

More than half of the course is devoted to banking in the United States. The legal and other differences between national banks, state banks, and trust companies are considered, but, as in the case of England, emphasis is laid upon the working of the system as a whole. Analysis of the different kinds of loans, the functions of the note broker, and the relations between banks in reserve cities and other banks is followed by a detailed examination of the working of the New York money market in relation to the rest of the United States and to the money markets of other countries. Finally, questions of a more general or public nature are examined, such as systems of note issue, required reserves, and the central reserve bank system; but the practical bearing of these questions is emphasized. So much of foreign exchange is taken up as seems necessary for a proper understanding of banking problems. Reports on the New York money market similar in scope to those upon the London market are prepared by the students. Experienced bankers deliver some special lectures.

Investments

Mr. Moors. Half-course (second half-year). Tu., Th., at 2.30.

In order to give the basis for forming a sound and conservative judgment in investment, this course discusses such subjects as the various kinds of investment suitable for different persons: bonds and stocks; savings bank and trust investments; the factors constituting the value of securities; the history of typical securities; stock exchanges; brokerage, legitimate and illegitimate; the mechanism of the money market; booms and panics; the economic functions and dangers of speculation. On the part of the class, considerable practice work is expected in the analysis of corporation reports and similar material.

Corporation Finance, with Especial Reference to Railroad Companies

Professor Sprague. Half-course (first half-year). Tu., Th., and (at the pleasure of the instructor) Sat., at 10.

The particular subject-matter of this course, the railroads, furnishes the most satisfactory approach to the detailed and concrete study of corporation finance. This is partly because railroad experience extends over a long period and because the data are abundant and, in recent years, have been put together in accordance with uniform requirements. Further, it may be added, much that is generally accepted as sound in financial practice, and also present methods of marketing securities are largely a result of experience with the railroads. In connection, therefore, with the railroads much necessary preliminary matter regarding such subjects as varieties of securities, underwriting, and reorganizations can profitably be considered.

Railroad reports are analyzed in detail, in order to familiarize the students with the nature and significance of the various standard methods of measuring railroad results and to make clear the many qualifications which must be borne in mind in applying these standards to the case of any particular road. Each student prepares reports upon the financial policy and experience of two railroads, covering a period of at least ten years.

This course is ordinarily open to students who have taken Accounting Principles and Investments, or their equivalents.

The Financial Management of Local Public Service Corporations

Professor Sprague. Half-course (second half-year). Tu., Th., and (at the pleasure of the instructor) Sat., at 10.

Eventually standards of sound practice and tests for measuring results will doubtless become more exact in the local utility field than is possible in the railroad business. At present these standards are being rapidly developed and consequently they are given especial attention in this course. The demand for the various services provided by local utility companies is analyzed, particular attention being given to the requirements of communities varying in population and in other respects. Much use is made of the valuable statistical reports of the various Massachusetts Commissions concerned with local utilities. Each student prepares reports upon the financial policy and experience of corporations engaged in each one of the more important varieties of local utilities. In conclusion, attention is given to the valuation of local utilities, to rate making, and to the policies of the more important State regulating commissions.

This course is open to students in the School of Business Administration who have taken Corporation Finance.

The Financial Management of Industrial Corporations

Professor Sprague. Half-course (second half-year). Tu., Th., and (at the pleasure of the instructor) Sat., at 12.

Each student makes a study of a single industry taken as a whole, giving especial attention to such matters as steadiness of demand for product, terms of purchasing material and payment for product, capital required for a given output, and methods of marketing. He then analyzes the financial policy and experience of a number of corporations engaged in his particular industry. Where a combination has been formed in the particular industry studied, the student endeavors to determine how this form of organization has influenced progressive advance in the industry and in what ways, if any, it has made possible economies in production and in marketing.

The course is conducted by means of individual conferences with students rather than by class-room work and lectures. At occasional meetings of those taking the course, each student presents the results of his investigation for discussion and criticism.

Attention is called to the following courses of research offered by the Faculty of Arts and Sciences: —

Economics 20*c*. Principles of Corporation Finance. Professor Ripley.

Economics 20*f*. Money, Banking, and Crises. Professor Sprague.

INSURANCE

Some knowledge of the theory and practice of insurance is useful to every business man, for there is no form of commercial activity which is not exposed to risk of loss that should be protected by insurance. Hence the elementary courses, although designed primarily for students who wish to specialize in insurance with a view to making it their profession, are planned also to meet the needs of the business man who desires such knowledge of insurance as will enable him to understand thoroughly the various contracts, and to select wisely that one which will most effectively safeguard his interests.

Fire Insurance

Mr. Medlicott. Half-course (first half-year). Th., 2.30–4.30.

This course treats of the history and general conduct of the fire insurance business; the relation of the underwriter to the state, the assured, and the agency force; the work of rate-making organizations, with explanation of schedules; the necessary qualifications and duties of the agent and broker; an outline of insurance company internal organization; the classification of risks and the different methods of determining relative hazards; the interpretation of standard policies; the rules and forms used in fire underwriting, with explanation of co-insurance, reinsurance, and other specific terms frequently found in the fire contract; the computation of reserve and statistical results for insurance accounting; the appraisal, adjustment, and settlement of losses, with special attention to apportionment under non-concurrent conditions.

Especial emphasis is given to the relation which insurance bears to credit, to the re-establishment of otherwise ruined enterprises, and to the replacement of properties that, but for the good offices of fire insurance, would be wholly lost to their owners.

The requirements imposed by the state relative to the maintenance of reserves, the form of the financial statements required yearly, and also the regulation by the State of the insurance soliciting and policy-writing privilege are carefully gone into.

Additional lectures are given by experts in special forms of insurance, such as marine, accident, employers' liability, workmen's compensation, and surety bonding insurance.

The course is conducted by lectures, prescribed readings, the preparation of reports on suggested topics, the solution of underwriting and adjustment problems, and class-room discussion.

Fire Insurance Engineering

Mr. Medlicott and others. Half-course (second half-year). Wed., Fri., 4.30–6.

The enormous fire waste of the United States is due not only to carelessness, but to the avoidable faults of construction, arrangement, and protection of buildings. The effect of this waste is a heavy increase in the cost of insurance, for the rate inevitably is graded by the loss.

The objects of the course are threefold: First, for the training of the fire insurance engineer or rate maker, to teach fundamental features of construction, protection, and fire prevention equipment, and of the materials and processes that constitute hazards.

Second, to give such a knowledge of what may be done by way of lessening the liability to fire, and effect such a saving in the cost of insurance as will enable the student intending to become a fire insurance broker or agent, to advise his customers with intelligence on these points.

Third, to furnish men who may become the owners or managers of buildings or business plants with such a knowledge of the fire hazard as shall enable them intelligently to safeguard their property, and to work out such conditions of construction equipment and process as will result in a lessening of the liability to fire, and a consequent reduction in the rate of fire insurance.

The course consists of lectures and laboratory and field work. Lectures by specialists take up features of construction, chemical, electrical and special hazards, protective devices, the various kinds of fire departments, and water supply systems. In the laboratory the students make tests of various protective devices; measurements of the flow of water from hydrants; the determination of the special features of hazard in combustible materials, and the best methods of handling such materials. The work in the field is carried on with inspectors of the Underwriters Bureau of New England, and the Boston Board of Fire Underwriters, and consists of actual inspection of selected properties that are insured by the insurance companies. This work also includes surveying of properties and the application of schedule rating systems in connection with them to determine the proper rate of insurance.

Life Insurance

Mr. Dow. Half-course (second half-year). Wed., Fri., 1.30–3.30.

The lectures in this course treat of the history of life insurance; the scientific basis of mortality tables and their application in computing premiums, annuity rates, and policy values; the established practice in regard to company management, organization of agency force, and medical selection; the usual methods of providing for expenses and the equitable distribution of surplus; a survey of industrial, fraternal, and assessment insurance; the proper relation of the different kinds of life insurance to the individual, and the extent to which the state exercises control over insurance corporations as regards taxation and supervision.

In addition to the lectures there are prescribed readings and frequent discussions of the practical problems that are daily presented to insurance offices, with special reference to the information needed by the successful solicitor. No mathematical training beyond elementary algebra is necessary for a satisfactory understanding of the work in the course.

Actuarial Practice

Mr. Dow. Half-course (second half-year). Two afternoon meetings a week; hours to be arranged.

Because of the advanced mathematical and theoretical standpoint from which the subject of life insurance is treated in this course the student should have taken courses in higher algebra and differential and integral calculus and should have some elementary knowledge of life insurance. The following subjects are treated: the construction and graduation of mortality tables, the valuation of the liabilities and assets of life insurance companies, the classification of risks, the insurance of under-average lives and extra premiums for special hazard, and the practical treatment of cases of alteration and surrender of life insurance contracts. In connection with the proper mathematical courses, the subjects are such as are required for admission as associate in the Actuarial Society of America. This course can be taken in connection with the elementary course in life insurance.

Attention is called to the following course in the list offered by the Faculty of Arts and Sciences: —

MATHEMATICS 9. Probability. Asst. Professor COOLIDGE.

TRANSPORTATION

The usual experience of the young man who enters railroad work is to find it so highly specialized departmentally that little opportunity is afforded him to gain information concerning the workings of the other departments. A broad knowledge of the whole field must, therefore, be of distinct advantage at the start, because it enables him better to understand the function of his own department and its relation to the whole transportation organization. The class room cannot take the place of practical experience, nor can the courses "teach railroading." They can, however, make it easier for the graduate to apply his practical experience more intelligently and to better advantage.

It is the aim of the courses to teach principles, and to use details only as they are necessary to make principles clear. They are intended also to train the mind of the student to analyze, to see beyond the detail, and to view each problem in its relation to the railroad as a whole.

Railroad Organization

Asst. Professor CUNNINGHAM. Half-course (first half-year). Mon., Wed., Fri., at 3.30.

It is the aim of this course to give a broad survey of the organization and business of a railroad, in the interest of those planning to enter the railroad service and desiring an understanding of the whole in which they are to be specialized units.

The discussion begins with the preliminaries of organization, the methods by which the project is financed, and the factors which determine railroad location, such as the effect of gradients and alinement, and the importance of the location on traffic development. Following a description of methods during the construction period, the organization of railroads for doing business is described in detail. The principal departments are taken up in turn, their relations with each other discussed, and the duties of the various officers examined with care. The organization charts of typical roads are studied and the reasons for variations in practice are explained. Reference is made to European systems in contrast to our own, and the relative advantages and disadvantages of departmental, divisional, and unit systems critically compared.

From the discussion of the internal organization, the course passes to that of external organization, or the relations of railroads to each other. Traffic associations, pools, and agreements of various kinds are considered, as well as operating and maintenance associations. Particular attention is given to the work of the American Railway Association, the Railway Engineering Association, the Signal Association, and the Master Car Builders' Association, and their committees. Finally, the course takes up the more important

American railroad systems, analyzing the causes for their degree of success.

Railroad Operation

Asst. Professor Cunningham. Mon., Wed., and (at the pleasure of the instructor) Fri., at 2.30.

This course is designed to afford a general knowledge of the workings of railroads, particularly of the operating department. As introductory to the strictly operating features, a non-technical survey is made of the physical characteristics and maintenance of the roadway and the economics of location. The design and maintenance of locomotives and cars are similarly dealt with, particularly from the viewpoint of the manager who is responsible for the efficient utilization of equipment as well as its economical maintenance.

The lectures are illustrated by diagrams, charts, photographs, and models, with reference to the recommended standards. Opportunity is afforded by actual inspection on New England lines to observe the features studied in the class-room.

An essential quality of the successful operating official being a capacity to " handle men," considerable attention is given to the relations between the railroads and their employees, general rules and legislation governing employment, methods of discipline, tests and examinations, wage schedules, and relations with labor organizations, including the recent standardizing of wages and working conditions through Federal arbitration.

A detailed study is then made of the design and operation of freight and passenger stations, and of yards and terminals, as well as the organization and operation of passenger and freight trains, including a critical study of the standard code of train rules. Then follows a discussion of train accidents, their nature, frequency, causes, and means of prevention. The different types of signal systems and their features of operation and maintenance are described, as well as the use of the telegraph and telephone in railroad work.

Statistics of operation are given emphasis, and the course concludes with a careful study of modern methods of keeping check on unit costs. Discussion and reports by students supplement the instruction by lectures. Some lectures on special topics are given by railroad officials who are experts in those fields.

Analysis of Railroad Problems

Asst. Professor Cunningham. Mon., Wed., and (at the pleasure of the instructor) Fri., at 11.

This course is designed for second-year students who have taken Railroad Operation. It supplements the first-year course with specific problems for analysis and conference. It is essentially a course in statistical analysis and requires much independent research and frequent reports.

As examples of the topics studied the following are mentioned: the economic results of grade revisions or the use of heavier locomotives; the ideal division of locomotive repairs between engine house " running repairs " and " shop repairs "; the advantages and disadvantages of pooling equipment; problems relating to depth and quality of ballast, weight and quality of rail, results of water softening; the practicability of dividing operating expenses between passenger and freight service, and of determining the " cost of service " in such cases as have been considered by the Interstate Commerce Commission in reviewing rates.

Special attention is given to the measures of efficiency in maintenance of way, structures, and equipment; and of the operation of stations, yards, and trains; including a detailed study of tonnage ratings and the freight train load.

The problems to be selected are determined by the preference of the student for certain lines of railroad work and his plans for the future, but emphasis is placed all through the course on statistical and analytical methods.

Railroad Rate-Making

Mr. Rich. Tu., 2.30–4.30.

A knowledge of traffic operations and of the Interstate Commerce Act is becoming an essential part of the equipment of a business man. The aim of this course is to provide for the needs of those who expect to engage in business or to enter Chamber of Commerce work, as well as of those who plan to enter the railroad service. The course opens with a consideration of economic theories of rate making, and also of the theories and practices adopted by railroads in reference to traffic. This is introductory to a careful study of the Interstate Commerce Act, as interpreted by the Interstate Commerce Commission and the courts, giving especial attention to the decisions of the Commission as they bear on the theory of rate making. Such topics as the following are discussed: — theories of railroad income in the aggregate; difference between rates which are non-competitive and rates which are competitive, as to carriers and as to markets; methods in practical use in determining rates; the principles and rules of classification; port and inland differentials; industrial railroads; private car lines; special transit privileges. The Act is also examined in detail with reference to the classes of traffic covered by the Act, the law relating to the establishment of through routes and joint rates, the extent of the obligation of the railroad to furnish cars and other facilities, the making of tariffs, lawful and unlawful preferences, the long and short haul clause, foreign *vs.* domestic rates, allowances to shippers, and procedure and practice before the Commission.

The principles underlying the reasonableness of individual rates will be discussed, with especial reference to cases actually pending before Federal and State Commissions.

Railroad Accounting

Half-course (second half-year).

Omitted in 1914–15; to be given in 1915–16.

Local accounting for passengers and freight and central accounting and auditing are studied in this course, in close touch with actual railroad experience. The use of typical forms is first explained, the various reports made by local agents described, and practice given in the making-up of station accounts and balance sheets. Then the work of the central office is taken up. The auditing of freight revenue and disbursements, the division of receipts on interline business between interested roads, the entries to be made on the several ledgers, the work of the general auditor or chief accounting officer are examined. In this connection the Interstate Commerce Commission's classification of revenues and expenses is discussed. Finally, the questions of claims, car service, car record, and similar matter which affect the accounting department are considered.

Attention is called to the following courses offered by the Faculty of Arts and Sciences: —

ENGINEERING SCIENCES 4*a* *hf*. Surveying. Professor HUGHES.

ENGINEERING SCIENCES 4*d*. Railroad Surveying. Professor HUGHES.

PRINTING AND PUBLISHING

The need for trained men in the printing business is far greater today than it was a generation ago. Then the implements of the trade were few and simple. There were only a few styles of type, only three or four kinds of presses, and comparatively few varieties of paper and ink. The work was mostly done by hand and the processes were simple and easily learned. A young man had ample opportunity to learn the entire trade and to get some business training as well in the course of a few years.

Today the industry has become so specialized that a workman cannot expect to become thoroughly familiar with more than a few of the various processes involved. There is so much to learn that one can hardly work up through the many departments of the shop into the commercial side of the business with hope of large success. Yet this commercial side requires trained men as never before. The growth of great printing and publishing concerns calls insistently for trained men to manage their manufacturing and business departments, — bigger and broader men, perforce, than those who have spent their school years in learning the rudiments of a trade.

To meet this need for men qualified to fill administrative positions the following courses are offered in connection with others given in the School; the complete program of instruction including, in addition to the courses here listed, courses in the principles of accounting, industrial accounting, factory management, marketing, business policy, and commercial law.

Printing and Publishing (First-year course)

Mr. C. C. Lane, assisted by Mr. Stone, and the following lecturers: Messrs. H. L. Baker, A. E. Barter, A. W. Elson, A. W. Finlay, H. B. Hatch, Amor Hollingsworth, A. D. Little, J. H. McFarland, Charles Schweinler, Donald Scott, and D. B. Updike. Tu., Th., 4.30–6, and a third hour at the pleasure of the instructor.

The object of this course is to provide an introduction to the technique of printing. It is intended to give the student a fairly comprehensive knowledge of the various operations and processes involved in the manufacture of a book, to show him the reason for each step that is taken, and to give him an opportunity to apply in practice what he learns. Particular attention is paid to the principles underlying the selection of type and to the comparative cost of similar processes. The following subjects are also considered: — the preparation of copy and proof-reading, type and composition, machine composition, paper-making and the physical qualities of paper, ink, reproducing processes, printing machinery, binding, printing office construction, printing office equipment, the routing of work, accounting, and office management. The course closes with a brief outline of the usual methods of distribution, with special reference to advertising and publishing.

In addition to the lectures, outside reading is assigned, and a few visits to printing offices are made. Written reports on these visits are called for, and the solution of practical problems is required. Throughout the course the aim is to direct attention to the fundamental principles which underlie this group of trades. No attempt is made to consider the innumerable details which the workman must learn in the shop, but an effort is made to give the student the definite information necessary for a clear grasp of each subject.

Printing and Publishing (*Second-year course*)

Mr. C. C. Lane and Mr. W. A. Dwiggins. Two meetings a week; hours to be arranged.

Intended to give the student practical experience in solving the problems which the superintendent or manager of a printing office must face, this course is carried on in connection with an established plant which is being reorganized in accordance with the best principles of shop management. Throughout the work theory and practice are closely related. The student is taught to design type pages of various kinds and to work out some of the underlying principles of design and harmony in type forms. He is given practice in preparing copy for the printer, in making out specifications, and in estimating costs. He studies the comparative effectiveness of machines and processes, and he plans in detail the work of a plant after being supplied with the necessary information concerning the amount of business to be handled. Special attention is given to the theory of cost accounting, and practical exercises in installing and using a cost system are provided. A number of representative printing offices are studied, and critical reports are called for on various aspects of the establishments considered. Throughout the course the student is encouraged to specialize in the subjects to which he wishes to devote himself, and under competent guidance to undertake independent investigations. The results of the student's work in his special field form the subject of a thesis to be prepared in the second half-year.

For students planning to enter the printing, publishing, or allied businesses attention is called to the following courses offered by the Faculty of Arts and Sciences: —

[FINE ARTS 5e [1]hf. The History of the Printed Book. *Half-course (first half-year).*]
Omitted in 1914–15.

FINE ARTS 5f [1]hf. The History and Principles of Engraving. *Half-course (first half-year).* MR. CARRINGTON.

[FINE ARTS 8a [1]hf. The Theory of Design. Asst. Professor POPE and Mr. E. O. PARKER.]
Omitted in 1914–15.

[ENGLISH 61 [2]hf. Eighteenth Century Periodicals. *Half-course (second half-year).* Asst. Professor GREENOUGH.]
Omitted in 1914–15.

COURSES FOR SECRETARIES OF CHAMBERS OF COMMERCE

Nearly every progressive community in the United States now has an active business men's association. There are over 650 of these organizations in the country having more than 200 members each. Most of these have at least one paid, permanent executive officer, and some have a large staff. These bodies are taking an active part in shaping and working out community plans for growth, and they are calling for high grade men as paid executives.

Hitherto these officers have been recruited from various sources — mainly from newspaper work. But as new standards are set by those officers who have grown up with the new conditions, and as the bodies enlarge their scope, there has arisen a demand for men with a professional training.

To meet this need a half-course in the first year and a full course in the second year, to be taken in connection with a group of our general courses, are devoted to a study of the problems of bodies of this kind.

Chamber of Commerce Work and Methods

Asst. Professor CHERINGTON and others. Half-course (second half-year). Mon., Wed., Fri., at 12.

Class-room study and discussion of the work of typical American chambers of commerce, boards of trade, and similar organizations are supplemented by examination of several hundred annual and special reports supplied by the bodies themselves. Organization structure is studied in the same way. A liberal amount of time is given to a study of the powers and limitations of the committee as a working method in chambers of commerce.

Some of the leading secretaries of chambers of commerce in the country come to Cambridge during the progress of the course, to discuss with the class important aspects of the work as they have found it.

Each member of the class is assigned to some nearby organization for practice work. Here he is given a task as an under-secretary and has an opportunity to learn some of the intimate details of the work. The Boston Chamber of Commerce, the Cambridge Board of Trade, the Malden Board of Trade, and the Lynn Chamber of Commerce have provided this form of practice work during the past year. The University is conveniently located for access to numerous organizations of this kind.

Chamber of Commerce Problems

Asst. Professor CHERINGTON. Hours to be arranged.

In the second year, the student who is preparing for a secretarial position in commercial organizations is required to take up some problem, or group of problems, in organization work for investigation in much greater detail than is possible in the preliminary half-course. Research work takes the greater part of the student's time available for this course. Frequent conferences and seminary sessions give an opportunity for reporting results and discussing variations in conditions.

This course is open only to students who have satisfactorily completed Chamber of Commerce Work and Methods.

LOCAL PUBLIC UTILITIES

The operation of public utilities, formerly regarded as primarily a field for the technical engineer, is now calling with more insistence for men trained in the new and more careful business methods. The course here offered considers from the standpoint of the management typical problems that confront gas and electric companies, furnishing light, heat, and power.

Public Utilities Operation

Mr. Mears, and the following lecturers; Messrs. M. L. Cooke, H. L. Doherty, L. D. Gibbs, L. R. Nash, Russell Robb, and E. N. Wrightington. Half-course (second half-year). Tu., Th., Sat., at 9.

After a brief consideration of the generation, transmission, and distribution of gas and electricity, the possibilities of central station business, with especial attention to personal calls and follow-up systems, demonstrating, advertising, and publicity work of all kinds, are discussed. Attention then is paid to the relations with contractors, supply companies, and regulating bodies; also to the significance of the load curve and the securing of off-peak business. Accounting, store-room systems, service department methods, with especial emphasis on rates, are among the other features treated.

This course is open to those who have satisfactorily completed the Factory Management (first-year course). Students are expected to make a written report on a selected company, and to make a series of visits to typical generating plants and commercial offices.

Attention is called to the following courses offered by the Faculty of Arts and Sciences: —

Chemistry 10 ²*hf*. Gas Analysis. Asst. Professor Baxter.

Engineering Sciences 16. Generation, Transmission, and Utilization of Electrical Energy. Professor Kennelly.

LUMBERING

With the changes that have taken place in recent years, the lumber business has come to offer an attractive field for trained men. In the earlier days of the industry, when timberland was abundant and relatively cheap, lumbering was largely a business of speculation in stumpage, and the rise in the value of the timber often made up the bulk of the profit. Under such conditions the manufacture and distribution of the product did not require the highest efficiency of organization. Meanwhile, the supply of timber has become greatly reduced, the business of handling it has become large and complicated, and the costs of labor, materials, and other factors, have gone up rapidly. The result has been that, deprived of the support of cheap stumpage, lumber companies are being compelled to operate on a narrow margin of profit. To secure this profit is more and more plainly a problem of management, of manufacture, including logging and milling, and of distribution, including transportation and selling.

Under these circumstances, the problems of wood production, of providing for future supplies of timber, urgent though they are, must still appeal to the capital invested in lumber as secondary to the problems of management. The realization of this is already wide-spread, not only among lumbermen, but also among foresters, large numbers of whom have found that it is only in the operating or the business end that they have found employment with lumber companies. It is to meet the opportunity of this situation, and the demand expressed by many lumbermen throughout the country, that the Harvard School of Business Administration and the Harvard School of Forestry are offering in coöperation a two years' course of training for the lumber business. This course is open and recommended not only to college graduates who look forward to some branch of lumbering as a life work, but also to graduates of forestry or engineering schools with whose special training the instruction in the lumber business can very profitably be combined. While the program of instruction with its courses in the Graduate School of Business Administration gives the general business foundation so essential to success in modern lumbering, it is of especial advantage to the student who desires to make the best use of his preparation, inclination, or connections that the opportunity of field training during the summer and the entire second half of the second year enables him to specialize. By putting the emphasis of his final work either on the operating or woods end of lumbering, on the manufacturing or saw-mill end, or on the selling or marketing, he will focus his training on the field where he expects employment.

General Lumbering

Mr. J. M. Gries. Half-course (second half-year). Hours to be arranged.

The purpose of this course is to give the student a broad view of the lumber industry in the United States, not only its development and the conditions at present controlling it, but also the nature of the problems connected with its future management. The course is to serve as a foundation for the more specialized investigative work to be undertaken in the second year. The industry will be dealt with primarily from a descriptive point of view, and will be taken up with relation to the various lumber producing regions of the country. There will be considered the fundamental factors which have controlled the growth and character of the business, such as geographical location, settlement, topography, climate, and conditions of labor. The conduct of the business itself will fall under the following heads: stumpage, its purchase and sale, logging, including transportation to the mill, the saw-mill, transportation of manufactured lumber, the market. In addition to a basis of information and general acquaintance with the organization of lumbering, which the exposition of these topics will give, the student will receive through the assignment of subjects for study and report an introduction to the character of the problems which are in need of investigation and solution in the coming development of the lumber business, whether on the subject of logging, of manufacture, or of distribution.

Principles of Forestry

Professors Fisher, Carter, Jack, and Bailey. Hours to be arranged.

The purpose of this course is to give men intending to enter the lumber business an understanding of the aims and importance of applied forestry, and of the general methods governing its practice. Such an understanding should underlie intelligent coöperation with the development of forestry in the future. The general outline of the course is a summary of technical forestry: the chief species of American trees and their identification; the important commercial timbers, with the main facts about their structure, gross characters, and uses; the biological and other natural laws controlling the life of the forest and its influence on its surroundings; and the principles underlying the practice of forestry as an art and a business.

A survey of so large a field will necessarily be general, but many topics of peculiar interest and importance to men having to do with large timberland ownership will be fully developed. What are the most practicable methods of reproducing forests, and to what extent can they be profitably applied by a business concern ? What, as a matter of established fact, is the effect of forests upon the distribution of surface and ground water, and hence upon stream flow ? How does fire affect present and future conditions in the forest, and what are the most effective means of protection against it ? What is the comparative efficiency and accuracy of the chief methods of measuring and valuing timberlands ? What are the principles governing the legislative action of towns, states, and the Federal Government in respect to forests ? The forest is vitally related to the perpetuation of industry, not alone through its production of wood, and it is an understanding of the nature of this relationship that the course aims to give.

Problems of the Lumber Business

Mr. J. M. Gries and an Assistant. (Second-year course during second half-year.)

This second-year course is intended to occupy the entire time of the second half-year, and to correlate and apply the previous instruction in the program. As a basis for it, the student is expected to have spent the summer following the first year's work in the employment of some lumber company. The purpose of the course is to give the student training in analyzing and utilizing the facts in a given phase or phases of the business. The work will be entirely in the field, and the nature of it will be adapted by consultation with the instructors to the student's previous training and to the sort of professional work he has in view. Practical problems connected with the business will be assigned him for investigation.

These may involve work in the operations of a number of companies in different regions, or they may require devotion of the whole time to the organization of one concern. Students who have had forestry or an engineering training may be given work connected with the logging end of the business; such problems, for example, as methods of surveying and valuing timber tracts of different types; railroad location and construction; comparative efficiency of various types of logging machinery; relation of logging costs to yield of stand per acre and price of resulting products. Other students, who are college graduates, without special technical preparation, or whose interest centered in problems of management, might profitably study such questions as organization plans, administrative methods, or an analysis of marketing methods.

As to the conduct of the work, each student will be in general charge of the instructor in lumbering with his assistants, who will direct the work in the field. The plan of work having been carefully settled, the student will be expected to make regular reports covering his progress. These reports will be criticised and commented upon, and the student will also be met at intervals for conference and discussion. The material and conclusion gathered in the investigation is embodied in a report, the construction and use of which will be an important element in his training.

PROGRAM OF COURSES FOR STUDENTS IN LUMBERING.

First year: —

- Accounting Principles.
- Marketing (first-year course).
- Factory Management (first half-year).
- General Lumbering (second half-year).
- Business Statistics (first half-year).
- Investments (second half-year).
- Principles of Forestry (for those who have not had previous work in Forestry).

SUMMER FIELD WORK IN THE LUMBER INDUSTRY.

Second year: The first half-year in the Graduate School of Business Administration, electing such courses as

Business Policy.
Industrial Accounting.
Corporation Finance.
Factory Management.

The second half-year is spent away from Cambridge. Each student is assigned a problem for field investigation upon which he is to write his graduation thesis under the supervision of the instructor.

The instruction given in other departments of the University, with the exception of exercises carried on in the special laboratories, is also open to students of the Graduate School of Business Administration. To students paying the full fee there is no extra charge. A certificate of membership in the School, from the Dean, is the only requirement.

BUREAU OF BUSINESS RESEARCH

Asst. Professor Martin, Director

The Bureau of Business Research was established in 1911 by the Graduate School of Business Administration to gather, to classify, and to describe facts about business. The main object of the Bureau is to get precise and reliable information about business for the Graduate School of Business Administration. An incidental but important work is to furnish this information in usable form for business men, and to institutions training for business. The Bureau is facilitated in its work by the inherently strategic position of a University in being a non-competing, trusted and permanent third party with scientific aims and methods.

So far, the Bureau has devoted itself to research in the field of market distribution, and in that field chiefly to the commodity shoes, beginning with its retail distribution. To overcome great variations in bookkeeping, a uniform system of accounting was devised for shoe retailers. After this Harvard System of Accounts for Shoe Retailers had been sufficiently adopted by the trade and figures based upon it gathered, it was possible to issue, in May, 1913, a bulletin based on the records of 130 stores that were fully comparable. In that bulletin were given the highest and lowest operating figures found, normal figures were given, and, still further, figures were set as standards generally attainable because already attained by an efficient group. A second edition of this bulletin was required in October, 1913. Data at that time collected from 650 stores did not affect materially the figures and standards of the first edition based on 130 stores.

Bulletin Number 2, of January, 1914, was a revised edition of the Harvard System of Accounts for Shoe Retailers based on the Bureau's three years' experience with 650 stores in 26 states. It is apparently becoming standard in the trade. Figures are now being collected on the wholesaling of shoes both by wholesalers and by manufacturers with stock departments. In June, 1914, the Bureau began a study of the marketing of groceries, following the general plan of the study of the marketing of shoes.

LIBRARY FACILITIES

The School has secured adequate study quarters for students in the new University Library building and will place therein all books and reports that are ordinarily consulted by students. A superintendent will be in charge of this room for the purpose of assisting students in their search for material. Special facilities in the Library building will be granted to advanced students.

The Library of the University contains over 1,000,000 bound volumes, and 700,000 pamphlets. It includes more than 24,000 volumes relating to Economics and an extensive collection of government documents, trade and labor periodicals, railroad reports, and banking and financial journals. The exceptionally comprehensive Library of the Harvard Law School, numbering over 160,000 volumes, is also available.

In Boston, the Public Library, second in size in the United States, contains a valuable statistical collection. Students of the School are granted admission to the library of the Insurance Library Association of Boston, the most complete of its kind in the United States.

SUMMER EMPLOYMENT FOR STUDENTS

Students are strongly advised, and in the absence of special circumstances are expected, at the end of the first year in the School to secure employment during the summer vacation, wherever possible, in the branch of business for which they are preparing themselves in the School. The practical experience thus gained is valuable for several reasons: students may thus serve before their graduation a portion of the inevitable and essential period of apprenticeship; they obtain that contact with men at work which is so valuable a portion of education and which is so essential in developing managing ability; moreover, through experience of the conditions in their profession, they may possibly choose more definitely the direction of their specialized work during the second year. The summer's pay is usually sufficient to cover bare living expenses. Leading business men in various lines have expressed their willingness to give summer employment to students of the School and to coöperate with the School by returning at the end of the period of employment a report on the work of the student. A permanent record of these reports is filed with the marks received by students for the work done in the School.

POSITIONS FOR STUDENTS AND GRADUATES

Graduates of the School will understand that on entering actual business life they will usually begin at the bottom and must submit willingly to the drudgery and discipline of routine work. This mastery of detail is an essential part of the training and cannot be gained except by such experience, but the apprenticeship may be shortened and made more valuable by applying the knowledge of principles systematically studied in the School. Though desirable positions for graduates and students have usually been obtained without difficulty, the School cannot guarantee positions to anyone. But, although this is obvious, its close relation with business firms throughout the country has resulted in frequent inquiries for men properly qualified to assume, after reasonable length of employment, positions of responsibility. Former members of the School are also constantly asking about students available after graduation. This first-hand information often proves of distinct value to past and present students.

In addition the University maintains an Appointment Office and a Students' Employment Office which offer their services to all graduates and students without charge. During the academic year 1912–13, the Students' Employment Office secured 2,183 temporary employments for students in residence. During the past year, with the coöperation of the departments, the Appointment Office obtained for graduates permanent salaried positions of an immediate annual value of $354,373.

All communications for the Students' Employment Office should be addressed to the Secretary for Student Employment, 9 University Hall, Cambridge, Mass.

PRIZES

Mr. George Oliver May offers two annual prizes of one hundred dollars and fifty dollars, respectively, for the best two graduation theses. Particulars concerning graduation theses are to be found in the statement describing requirements for the degree, on pages 11 and 12.

Mr. Harry Hodgson offers an annual prize of twenty-five dollars for the best essay by a first-year student on any phase of the business activities in the Southern states. Theses prepared as part of the regular work in any of the courses in the School are eligible for this prize. Competitors must submit their theses to the Dean before April 25.

LOAN FUND AND OTHER PECUNIARY AIDS

The five University Scholarships of one hundred and fifty dollars each, formerly open to students in the School, have been abolished and an equivalent amount will be appropriated for several years for the benefit of the loan fund in the School. This fund was established through the generosity of friends of the School for the benefit of students who are in need of pecuniary assistance. As a rule, only second-year students of promise can hope to receive assistance from this source.

The following are among the Fellowships and Scholarships available in other Departments of the University as well as in the Graduate School of Business Administration: —

The Scholarship of the Harvard Club of Chicago; with an income of three hundred dollars. Maintained by the Harvard Club of Chicago; . . . to be awarded to a graduate of an Illinois university or college who wishes to pursue graduate studies at Harvard University . . . to be appointed by a committee of the Club.

THE SCHOLARSHIP OF THE HARVARD CLUB OF HAWAII; with an income of two hundred dollars. This scholarship was founded in 1908, to be awarded " to a deserving student in any department of Harvard University, nominated by the Harvard Club of Hawaii subject to the approval of the Committee on Scholarships and Other Aids for Undergraduates of Harvard University. It is proposed to maintain the scholarship by annual contribution; the award to be made with the understanding that it is a loan, repayable after a term of years."

THE SCHOLARSHIP OF THE HARVARD CLUB OF NEBRASKA; with an income of one hundred and fifty dollars, open to a graduate of a Nebraska high school, or Nebraska college or university, during his first year of residence.

THE CHARLES ELLIOTT PERKINS SCHOLARSHIP; with an income of three hundred dollars, " to be offered each year to a graduate of an Iowa college or university in any of the graduate or professional departments of Harvard University." The terms of gift are quoted further in the University Catalogue for 1913–14, page 550.

THE PRINCETON FELLOWSHIP; with a stipend of four hundred and fifty dollars. From a graduate of Princeton University, to be awarded to a graduate of that University studying in any department of Harvard University.

THE SCHOLARSHIP OF THE ROCKY MOUNTAIN HARVARD CLUB. Maintained since 1890 by the Rocky Mountain Harvard Club, of Denver, Colorado; to be awarded to a promising graduate of a Colorado college or school pursuing his studies at Harvard University; the appointment to be made annually by a committee of the Club.

THE JAMES A. RUMRILL GRADUATE SCHOLARSHIP; with an income of two hundred and twenty-five dollars. This scholarship, established in memory of JAMES AUGUSTUS RUMRILL, of Springfield, Mass., a member of the Class of 1859, will be offered each year to a properly qualified graduate of a college or university in Virginia, North Carolina, South Carolina, Florida, Georgia, Tennessee, or Kentucky, who desires to pursue his studies in one of the graduate departments of Harvard University.

THE EDWARD RUSSELL SCHOLARSHIP; with an income of two hundred and seventy-five dollars. Founded by EDWARD RUSSELL, of Boston, "to be known as the Edward Russell Scholarship, as a memorial to my grandfather of that name, who was graduated at the College in class of 1759; and to my father of same name who was graduated at the College in class of 1803." This scholarship may be awarded to a student in a graduate department of the University. It may be divided at the discretion of the Scholarship Committee.

THE FREDERICK SHELDON FUND FOR TRAVELLING FELLOWSHIPS AND SCHOLARSHIPS. The income of this Fund is available for holders of any degree from Harvard University. For further particulars, see University Catalogue for 1913–14, page 577.

FEES

TUITION FEES

The regular annual tuition fee for every student in the Graduate School of Business Administration doing full work is *one hundred and fifty dollars*. This fee is charged to every student who holds a scholarship, or who wishes to have the year counted to him as a complete year of study for a degree.

Laboratory fees must be paid in addition to the tuition fee by students who take laboratory courses.

Students in the Graduate School of Business Administration not doing full work may pay fees for the courses which they take, instead of paying the full tuition fee of a student in regular standing. But a student paying less than one hundred and fifty dollars is not allowed to be the holder of a fellowship or scholarship, or to count the year as a full year of study for a degree.

The fees for single courses are forty-five dollars for a full course and twenty-five dollars for a half-course, but in no case shall the tuition fee for the year be less than thirty dollars.

No deduction for absence or withdrawal is made from the fees for single courses. A student who attends a course of instruction for only a part of the year must pay the whole fee for such course. But a student who is liable for the full tuition fee of *one hundred and fifty dollars* a year is entitled to the same remission as a student in regular standing.

INFIRMARY FEE

A fee of four dollars a year is charged to every resident student registered in the Graduate School of Business Administration for the maintenance of the Stillman Infirmary; and, on the order of a physician, every such student will be given, in case of sickness, in return for this fee, a bed in a ward, board, and ordinary nursing for a period not exceeding two weeks in any one academic year. Married students who wish to forego the benefit of the Infirmary may be exempted from the Infirmary fee by making application in writing to the Bursar on or before October 5 in each academic year.

GRADUATION FEE

A graduation fee of twenty dollars is charged to each student taking a degree in the School.

BONDS

Every resident student must file with the Bursar a bond in the sum of *two hundred dollars*, signed by two bondsmen, one of whom must be a citizen of the United States, or by a surety company duly qualified to do business in Massachusetts, as security for the payment of University bills; or he may deposit with the Bursar two hundred dollars in United States bonds for the same purpose; or he may deposit *fifty dollars* as security and pay in advance all sums for which he shall become liable to the University. Money deposited as security is returnable after the issue of the second term-bill, one week before Commencement.

If, however, he occupies a College room or boards at Memorial Hall or at Foxcroft Hall he must file a bond for *four hundred dollars*, or must in advance, and in addition to his tuition fees, pay the full year's rent of his room, and make a deposit as security for the payment of his board at the rate of *five dollars a week*.

No officer or student of the University is accepted as a bondsman.

Blank forms of bonds may be obtained on application to the Bursar or to the Secretary of the Graduate School of Business Administration.

PAYMENT OF THE TUITION FEE—TERM-BILLS

Each student liable for full tuition is required to pay ninety dollars of the tuition fee to the Bursar punctually at the beginning of the academic year without the presentation of a bill. The second instalment, of sixty dollars, is entered upon the first term-bill, issued January 20, and is to be paid on or before February 10.

In like manner students who are liable for less than the full tuition fee of one hundred and fifty dollars are required to pay at the beginning of the academic year ninety dollars, or the whole fee if it does not exceed ninety dollars; and the remainder of the fee, if any, on or before February 10.

The first term-bill includes, in addition to the second instalment of the tuition fee, such charges as the following: Two-thirds of the year's charges for the use of a College room; fees for laboratory courses which begin in the first half-year; Stillman Infirmary fee; locker fees; such incidental charges as can then be determined; charges for gas, and for board at Memorial Hall and at Foxcroft Hall, made up to as late a date as practicable.

The second term-bill is issued one week before Commencement, and contains charges not included in the first bill. The second term-bill must be paid by all candidates for degrees at least one day before Commencement; and, by all other students, on or before July 20.

Students who are candidates for degrees in the middle of the academic year must pay all dues to the University at least one day before the day upon which the degrees are to be voted.

When a student's connection with the University is severed, all charges against him must be paid at once.

Each student whose dues to the University remain unpaid on the day fixed for their payment is required at once to cease attending lectures or recitations, using the libraries, laboratories, gymnasium, athletic grounds or buildings, boarding at the Harvard Dining Association or at the Foxcroft Hall Association, and making use of any other privileges as a student, until his financial relations with the University are satisfactory to the Bursar. Failure to comply with this rule is deemed cause for final separation of the student from the University.

STUDENTS, 1913–14

Second Year

Bowser, Henry Reed, A.B. 1912,	***Richmond, Va.***	**Brentford 37**
Brown, Daniel Lucius, A.B. (*Brown Univ.*) 1912,	***Norwich, Conn.***	**Craigie 303**
Coffey, James B., A.B. (*Holy Cross Coll.*) 1912,	***Worcester,***	**6 Ingalls St., Worcester**
Collins, Charles Frederick, A.B. (*Boston Univ.*) 1912,	***Dorchester,***	**120 Mt. Auburn St.**
Dawes, Irving Desmond, S.B. 1912,	***Arlington,***	**26 Addison St., Arlington**
Dillingham, William Pitt, A.B. 1911,	***Boston,***	**178 Commonwealth Ave., Boston**
Driscoll, Robert Edward, A.B. (*Univ. of Michigan*) 1911,	***Lead, So. Dak.***	**W. H. 43**
Egan, John Kelly, A.B. (*Univ. of Minnesota*) 1912,	***St. Paul, Minn.***	**Fairfax 31**
English, Donald, S.B. (*Univ. of California*) 1909,	***Oakland, Cal.***	**40 Kirkland St.**
Fensterwald, Ralph, S.B. (*Vanderbilt Univ.*) 1912,	***Nashville, Tenn.***	**W. H. 45**
Folsom, Marion Bayard, A.B. (*Univ. of Georgia*) 1912,	***McRae, Ga.***	**40 Kirkland St.**
Gill, Howard Belding, A.B. 1913,	***Lockport, N. Y.***	**36 Quincy St.**
Grant, Edwin Stanley, A.B. (*Oberlin Coll.*) 1912,	***Springfield, O.***	**15 Ellsworth Ave.**
Hite, Hugh Dalby, A.B. (*Randolph-Macon Coll.*) 1910,	***Earls, Va.***	**67 Oxford St.**
Hubbard, Walter John, Jr., A.B. (*Wabash Coll.*) 1912,	***Indianapolis, Ind.***	**Ware 30**
Keister, Donald Cormany, A.B. (*Lebanon Valley Coll.*) 1912,	***Scottdale, Pa.***	**10 Remington St.**
Lafferty, Clarence Jay, B.L. (*Westminster Coll.*) 1912,	***Trenton, Mo.***	**1683 Cambridge St.**
Levy, John, A.B. 1913 (1912),	***Boston,***	**1617 Tremont St., Boston**
Manning, Edward Wilkinson, A.B. (*Boston Coll.*) 1912,	***Cambridge,***	**235 Upland R'd**
Millea, John Edward, A.B. (*Clark Coll.*) 1910,	***Worcester,***	**10 Goddard St., Worcester**
Neiswanger, Donald Mohler, A.B. (*Washburn Coll.*) 1911,	***Topeka, Kan.***	**P. 62**

Paine, Nathaniel Emmons, Jr., A.B. 1913,	*W. Newton,*	Ware 49
Pope, John Blakely, Jr., S.B. (*Polytechnic Coll.*) 1912,	*Fort Worth, Tex.*	Westmorly 34
Reisenhus, James Arthur, M.E. (*Lewis Institute, Chicago*) 1911,	*Chicago, Ill.*	83 Trowbridge St.
Smith, Henry Gordon, A.B. 1913,	*New York, N. Y.*	Ware 49
Smith, John Aloysius, A.B. (*Clark Coll.*) 1912,	*Worcester,*	65 Vernon St., Worcester
Taylor, Henry Huntly, A.B. (*Leland Stanford Jr. Univ.*) 1900,	*San Francisco, Cal.*	Winthrop 22
Tsao, Yunsiang, A.B. (*Yale Univ.*) 1911,	*Shanghai, China,*	H'ke 39
Walker, William Laurence, S.B. (*Utah Agricultural Coll.*) 1908,	*Logan, Utah,*	15 Ellsworth Ave.
Wedelstaedt, Henry Albert von, A.B. 1912,	*St. Paul, Minn.*	Fairfax 20
White, Gilbert Vincent, S.B. (*Acadia Univ.*) 1909, A.M. (*ibid.*) 1911,	*Summerland, B. C.*	12 Oxford St.
Wyner, Samuel Newton, A.B. 1913 (1912),	*Dorchester,*	53 Oxford St.

FIRST YEAR

Baker, Matthias Wisen, Jr., A.B. (*Brown Univ.*) 1911,	*Providence, R. I.*	2 Avon St.
Barbour, Alexander Lambert, A.B. (*Yale Univ.*) 1913,	*New York, N. Y.*	Craigie 402
Bool, Timothy Dwight, A.B. 1914,	*Cambridge,*	M. 27
Bowser, Robert, A.B. 1913,	*Richmond, Va.*	52 Mt. Auburn St.
Browne, Carl Gray, A.B. 1914,	*Old Town, Me.*	W. 1
Burroughs, Leroy Francis, PH.B. (*Brown Univ.*) 1912,	*Pawtucket, R. I.*	61 Oxford St.
Chang, Loy, A.B. 1913,	*Lahaina, Mani, Hawaii,*	12 Sumner R'd
Cheatham, Tyra Ozro, Jr., A.B. (*Univ. of Texas*) 1911,	*Waxahachi, Tex.*	29 Ware St.
Cochran, Harold Curry, A.B. (*Clark Coll.*) 1913,	*Worcester,*	1746 Cambridge St.
Compton, William Taylor, A.B. (*Ohio Wesleyan Univ.*) 1912,	*Ancon, C. Z., Panama,*	44 Fenway, Boston
Coyne, Charles Everett, A.B. (*Clark Coll.*) 1913,	*Fisherville,*	1734 Cambridge St.

Cushman, Albert Percival, A.B. (*Bowdoin Coll.*) 1913,	*Bangor, Me.*	66 Kirkland St.
Dreiss, Edward, Jr., S.B. (*Agricultural and Mechanical Coll. of Texas*) 1913,	*San Antonio, Tex.*	27 Ware St.
Drinkwater, Harold Paul, A.B. (*Univ. of Colorado*) 1913, B.C.S. (*ibid.*) 1913,	*Denver, Colo.*	120 Mt. Auburn St.
Edwards, Burgess Allison, A.B. 1914,	*Boston,*	T. 49
Eisner, Monroe, A.B. 1914,	*Red Bank, N. J.*	Dana 35
Foster, James Paul, A.B. (*Boston Univ.*) 1913,	*Boston,*	44 So. Russell St., Boston
Fritchey, Theodore Augustus, Jr., A.B. (*Univ. of Illinois*) 1913,	*Olney, Ill.*	1727 Cambridge St.
Frost, Horace Wier, A.B. 1914,	*Chelsea,*	T. 31
Gifford, Phillip Collins, A.B. (*Haverford Coll.*) 1913,	*Providence, R. I.*	C't 32
Greeley, Thornton, A.B. 1913,	*Butler, Pa.*	Brentford 41
Hanson, Donald Rea, S.B. 1914	*Melrose Highlands,*	H. 20
Huff, Truman Claude, A.B. (*Ohio Wesleyan Univ.*) 1913,	*Leesburg, O.*	45 Trowbridge St.
Hull, Richard Ayre, A.B. 1913,	*Dorchester,*	P. 28
Jackman, David Stockdale, A.B. (*Fairmount Coll.*) 1913,	*Wichita, Kan.*	M. 47
Jones, John Langdon, A.B. 1913,	*Roxborough, Pa.*	Dana 32
Koch, William Conrad, S.B. 1913,	*St. Paul, Minn.*	W. 1
Lemon, Alfred Bunyan, A.B. (*Brown Univ.*) 1913,	*Cleveland, O.*	Drayton 9
Lincoln, Nathan Burnham, A.B. 1913,	*Cambridge,*	18 Fayette St.
Loomis, Franklin Holcomb, PH.B. (*Yale Univ.*) 1913,	*Derby, Conn.*	16 Trowbridge St.
Lowell, Arthur Kenney, S.B. (*Dartmouth Coll.*) 1913,	*Reading,*	103 So. Main St., Reading
Lundquist, Walter Elroy, S.B. (*Knox Coll.*) 1913,	*Galesburg, Ill.*	C't 28
Lusby, Willis Emery, A.B. (*Washburn Coll.*) 1913,	*Topeka, Kan.*	P. 76
McCarthy, Charles Edward, S.B. (*Dartmouth Coll.*) 1912,	*Melrose,*	16 Sewall St., Melrose
McCarthy, Walter David, A.B. (*Holy Cross Coll.*) 1913,	*Fitchburg,*	56 Forest St., Fitchburg

Macdonough, Joseph Gardner, A.B. 1913,	*New York, N. Y.*	10 Hilliard St.
Marshall, Wycliffe Clyde, A.B. 1911,	*Cambridge,*	828 Mass. Ave.
Mullen, Edward Francis, A.B. 1913,	*Brookline,*	11 Orkney R'd, B'kline
Murphy, Ralph Elder, A.B. (*Univ. of Southern California*) 1913,	*Los Angeles, Cal.*	P. 76
Nickerson, Howard Tarbell, A.B. 1913,	*Milton,*	114 Canton Ave., Milton
Osmond, James George, S.B. (*Utah Agricultural Coll.*) 1912,	*Logan, Utah,*	15 Ellsworth Ave.
Osteyee, Herbert Farwell, A.B. (*Brown Univ.*) 1913,	*Hinsdale, N. H.*	Drayton 9
Philippbar, Wallace Daniel, S.B. 1909,	*Buffalo, N. Y.*	1352 Mass. Ave.
Pike, Sumner Tucker, A.B. (*Bowdoin Coll.*) 1913,	*Lubec, Me.*	53 Oxford St.
Pratt, Isaac Cleo, S.B. (*Knox Coll.*) 1913,	*Roseville, Ill.*	Ware 33
Remey, John Terry, S.B. 1913,	*Washington, D. C.*	Hampden 27
Roberts, Raymond Moulton, S.B. (*Tufts Coll.*) 1913,	*Melrose Highlands,*	124 Franklin St., Melrose H'ld's
Robinson, Ben Isaac, PH.B. (*Brown Univ.*) 1913,	*Providence R. I.*	168 Lippitt St., Providence, R. I.
Rogers, Charles Merrill, Jr., A.B. 1914,	*Cambridge,*	T. 47
Romney, George Ottinger, A.B. (*Univ. of Utah*) 1912, A.M. (*ibid.*) 1913,	*Salt Lake City, Utah,*	Craigie 105
Rosenstein, Joseph, A.B. 1913,	*Boston,*	1 Leonard Ave.
Ryan, Charles Diller, A.B. 1910,	*Springfield, Ill.*	6 Story St.
Shepard, Charles Frederic, A.B. (*Dartmouth Coll.*) 1912,	*Aurora, Ill.*	69 Oxford St.
Shu, Sawland J, S.B. (*Univ. of Wisconsin*) 1913,	*Kwei-yan, Kwei-chow, China,*	64 Kirkland St.
Smith, Robert Reese, S.B. (*Oklahoma Agricultural and Mechanical Coll.*) 1913,	*Chickasha, Okla.*	W. H. 11
Smith, William Bush, A.B. (*Westminster Coll.*) 1912,	*Fulton, Mo.*	83 Trowbridge St.
Spohn, Carlysle Bonham, A.B. (*Wabash Coll.*) 1913,	*Goshen, Ind.*	Ware 41

Standish, James Darrow, Jr., A.B. (*Williams Coll.*) 1913,	*Detroit, Mich.*	46 Griggs R'd, B'kline
Stone, Wendell Alden, PH.B. (*Adrian Coll.*) 1913,	*Hopwood, Pa.*	120 Mt. Auburn St.
Sun, Hyne, A.B. (*Yale Univ.*) 1913,	*Hangchow, Chekiang, China,*	45 Oxford St.
Voort, Joseph Nelson van der, LITT.B. (*Princeton Univ.*) 1908,	*Dunkirk, N. Y.*	54 Langdon St.
Walker, Joseph Richmond, A.B. (*Yale Univ.*) 1913,	*Brookline,*	108 Upland R'd, B'kline
Wilcox, Sanford Potter, A.B. (*Amherst Coll.*) 1913,	*Grand Rapids, Mich.*	Ware 9
Wooden, Robert Edgar, S.B. (*Northwestern Univ.*) 1913,	*Centerville, Ia.*	W. H. 11
Worcester, Willard Seely, A.B. 1912,	*Detroit, Mich.*	36 Quincy St.
Wright, Richard William, Jr., A.B. 1913,	*Readville,*	1865 Hyde Park Ave., Readville

UNCLASSIFIED STUDENT†

Cisco, John Jay, Jr.	*New York, N.Y.*	Westmorly 133

SPECIAL STUDENTS

Barnes, Karl Schenck,	*Cambridge,*	33 Concord Ave.
Cole, George Ellsworth Thomas, A.B. (*Clark Coll.*) 1911,	*Bridgeport, Conn.*	83 Union St., Watertown
Craigie, Victor Raleigh,	*Boston,*	722 Commonwealth Ave., Boston
Cunningham, Wendell Thomas, A.B. (*Clark Univ., Atlanta, Ga.*) 1913,	*Atlanta, Ga.*	74 Hammond St., Boston
Curtis, Arnold Sawyer, A.B. 1912,	*Marlboro,*	233 Church St., Marlboro
Howe, Frederick Stanley, A.B. 1908,	*Cambridge,*	7 Exeter P'k
Howe, Harry Reginald, S.B. 1912,	*Watertown,*	105 Palfrey St., Watertown
Lord, Everett William, A.B. (*Boston Univ.*) 1900, A.M. (*ibid.*) 1906,	*Jamaica Plain,*	10 Park Lane, Jam. Pl.
Morss, Robert Dillingham, A.B. (*Bowdoin Coll.*) 1910,	*Boston,*	29 Beacon St., Boston
Roland, Spencer Brown, LL.B. (*Univ of Pennsylvania*) 1903,	*Reading, Pa.*	139 Hancock St.
Rowland, Earl LeFever,	*Walden, N. Y.*	Norwood
Sinclair, Paul Elmer,	*Pittsburgh, Pa.*	36 Mt. Auburn St.

---

† Will be admitted as regular student when certain deficiencies (not amounting in any case to more than a single course) in requirements for A.B. in Harvard College are made up.

Sproul, Alexander Hugh, S.B. (*So. Dakota State Coll. of Agriculture and Mechanic Arts*) 1894, S.M. (*ibid.*) 1895,	*Salem,*	3 Naples R'd, Salem
Stetson, Frank Owen, S.B. (*Mass. Inst. of Technology*) 1888,	*Newton,*	219 Market St., Lynn
Stone, Walter Moreland, A.B. 1908,	*Somerville,*	152 Central St., Somer.
Vroom, Frederic Keiter,	*Exeter, N. H.*	10 Oxford St.
Wells, Arthur Stethus, S.B. (*Dartmouth Coll.*) 1906,	*Boston,*	41 Batavia St., Boston
Woodworth, Arthur Vernon, A.B. 1891, B.D. (*Episcopal Theol. School*) 1894, PH.D. (*Univ. of Freiburg*) 1896,	*Boston,*	30 Chestnut St., Boston

SUMMARY

SECOND-YEAR STUDENTS	32
FIRST-YEAR STUDENTS	66
UNCLASSIFIED STUDENT	1
SPECIAL STUDENTS	18
TOTAL	117

COLLEGES REPRESENTED

Acadia University	1
Adrian College	1
Agricultural and Mechanical Col.. of Texas	1
Amherst College	1
Boston College	1
Boston University	3
Bowdoin College	8
Brown University	6
Clark College	5
Clark University, Atlanta, Ga.	1
Dartmouth College	4
Fairmont College	1
Harvard University	39
Haverford College	1
Holy Cross College	2
Knox College	2
Lebanon Valley College	1
Leland Stanford Jr. University	
Lewis Institute, Chicago	1
Massachusetts Institute of Technology	1
Northwestern University	1
Oberlin College	1
Ohio Wesleyan University	2
Oklahoma Agricultural and Mechanical College	1
Princeton University	1
Polytechnic College	1
Randolph Macon College	1
So. Dakota State College	1
Tufts College	1
University of California	1
University of Colorado	1
University of Georgia	1
University of Illinois	1
University of Michigan	1
University of Minnesota	1
University of Pennsylvania	1
University of Southern California	1
University of Texas	1
University of Utah	1
University of Wisconsin	1
Utah Agricultural College	2
Vanderbilt University	1
Wabash College	2
Washburn College	2
Westminster College, Mo.	2
Williams College	1
Yale University	5
Total number of Colleges represented	47

DEGREES

ON COMMENCEMENT DAY, JUNE 18, 1914, DEGREES WERE CONFERRED AS FOLLOWS: —

M.B.A.

Henry Reed Bowser, A.B. 1912.
James B. Coffey, A.B. (*Holy Cross Coll.*) 1912.
Charles Frederick Collins, A.B. (*Boston Univ.*) 1912.
Irving Desmond Dawes, S.B. 1912.
Robert Edward Driscoll, A.B. (*Univ. of Michigan*) 1911.
John Kelly Egan, A.B. (*Univ. of Minnesota*) 1912.
Howard Belding Gill, A.B. 1913.
Edwin Stanley Grant, A.B. (*Oberlin Coll.*) 1912.
Hugh Dalby Hite, A.B. (*Randolph-Macon Coll.*) 1910.
Walter John Hubbard, Jr., A.B. (*Wabash Coll.*) 1912.
Donald Cormany Keister, A.B. (*Lebanon Valley Coll.*) 1912.
Clarence Jay Lafferty, B.L. (*Westminster Coll.*) 1912.
John Levy, A.B. 1913 (1912).
Edward Wilkinson Manning, A.B. (*Boston Coll.*) 1912.
John Edward Millea, A.B. (*Clark Coll.*) 1910.
Donald Mohler Neiswanger, A.B. (*Washburn Coll.*) 1911.
John Blakely Pope, Jr., S.B. (*Polytechnic Coll.*) 1912.
James Arthur Reisenhus, M.E. (*Lewis Institute, Chicago*) 1911.
Henry Gordon Smith, A.B. 1913.
John Aloysius Smith, A.B. (*Clark Coll.*) 1912.
Henry Huntly Taylor, A.B. (*Leland Stanford Jr. Univ.*) 1900.
Yunsiang Tsao, A.B. (*Yale Univ.*) 1911.
William Laurence Walker, S.B. (*Utah Agricultural Coll.*) 1908.
Henry Albert von Wedelstaedt, A.B. 1912.
Gilbert Vincent White, S.B. (*Acadia Univ.*) 1909, A.M. (*ibid.*) 1911.

M.B.A. WITH DISTINCTION

Donald English, S.B. (*Univ. of California*) 1909.
Ralph Fensterwald, S.B. (*Vanderbilt Univ.*) 1912.
Marion Bayard Folsom, A.B. (*Univ. of Georgia*) 1912.

TABULAR VIEW OF CLASS EXERCISES — MONDAY, WEDNESDAY, AND FRIDAY

Hour	9	10	11	12	1.30	2.30	3.30	4.30–6
Course	Marketing (1st-yr. course)	Accounting Practice (2d hf. yr.)	Accounting Principles	Accounting Problems	Foreign Trade Methods (1st hf. yr.)	Railroad Operation	Railroad Organisation (1st hf. yr.)	Factory Management (1st-yr. course) (1st hf. yr.)
		Industrial Accounting (1st hf. yr.)	Analysis of Railroad Problems	Chamber of Commerce Work and Methods (2d hf. yr.)	Life Insurance (2d hf. yr.) (Wed. & Fri.)			Fire Insurance Engineering (2d hf. yr.) (Wed. & Fri.)
	Business Policy	Law relating to Banking Operations (1st hf. yr.)						

TUESDAY, THURSDAY, AND SATURDAY

Hour	9	10	11	12	1.30	2.30–4.30	4.30–6
Course	Business Statistics (1st hf. yr.)	Commercial Contracts	Banking	Law relating to Business Associations		Investments (2d hf. yr.), (Tu., also Th., 2.30–3.30)	Printing and Publishing (1st-yr. course) (Tu. & Th.)
	European Trade (2d hf. yr.)	Corporation Finance (1st hf. yr.)		Financial Management of Industrial Corporations (2d hf. yr.)		Fire Insurance (1st hf. yr.) (Th. only)	
	Public Utilities Operation (2d hf. yr.)	Financial Management of Local Public Service Corporations (2d hf. yr.)				Railroad Rate-Making (Tu. only)	Law relating to Railroad Rate-Making (2d hf. yr.) (Tu. only)

In the following courses the hours to be arranged: —

Marketing (second-year course)
Factory Management (second-year course)
The Taylor System of Management

Actuarial Practice
Printing and Publishing (second-year course)
Chamber of Commerce Problems

General Lumbering
Principles of Forestry
Problems of the Lumber Business

OFFICIAL REGISTER OF HARVARD UNIVERSITY

VOLUME XIV MAY 29, 1917 NO. 29

BUSSEY INSTITUTION FOR RESEARCH IN APPLIED BIOLOGY

(ADDRESS: FOREST HILLS, BOSTON, MASS.)

1917–18

PUBLISHED BY HARVARD UNIVERSITY
CAMBRIDGE, MASS.

BUSSEY INSTITUTION FOR RESEARCH IN APPLIED BIOLOGY

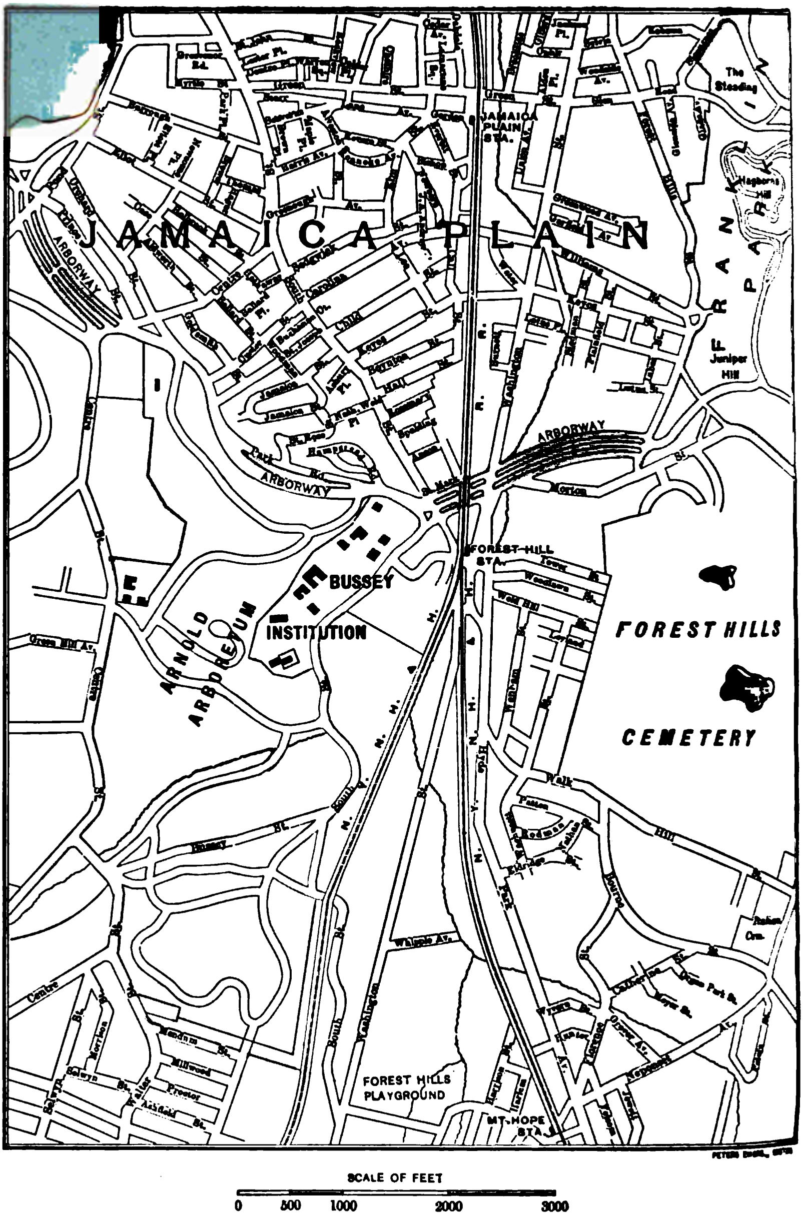
ECONOMIC ENTOMOLOGY, ANIMAL GENETICS, PLANT GENETICS, DENDROLOGY, SILVICULTURE, FOREST MANAGEMENT, PLANT ANATOMY, AND ECONOMIC BOTANY

1917–18

PROPERTY OF DIVISION OF
FOR
COLLEGE OF
UNIVERSITY OF

CAMBRIDGE
PUBLISHED BY THE UNIVERSITY
1917

For General Information Address the Secretary
Bussey Institution, Forest Hills, Boston, Mass.



HARVARD UNIVERSITY: BUSSEY INSTITUTION AND ARNOLD ARBORETUM. 394 ACRES

CALENDAR

1917.

April 1. Last day for receiving applications for scholarships for 1917–18 in the Bussey Institution.

May 1. Last day for receiving theses of candidates for the degree of S.D. in June, 1917.

June 10. SUMMER TERM BEGINS: registration at the Bussey Institution, Forest Hills, Boston, Mass.

June 21. Commencement: all departments of Harvard University. Exercises in Cambridge.

Sept. 15. Applications for the master's degree at midyears, and for admission, during the fall-winter term, to examinations for the degree of S.D. must be made on or before this date.

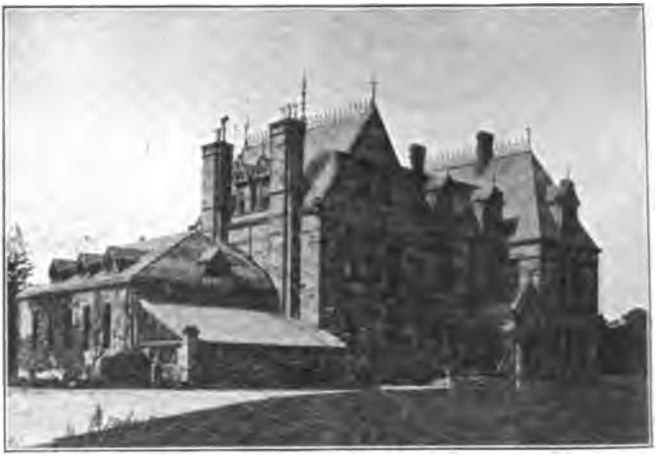
Sept. 24. FALL-WINTER TERM BEGINS: registration at the Bussey Institution, Forest Hills, Boston, Mass. Academic year begins in all other departments of Harvard University on this date.

1918.

Jan. 1. Last day for receiving theses of candidates for the degree of S.D. in February, 1918.

Jan. 15. Application for the master's degree at Commencement and for admission, during the spring term, to examinations for the degree of S.D. must be made on or before this date.

Feb. 11. SPRING TERM BEGINS: registration at the Bussey Institution, Forest Hills, Boston, Mass. Second half of the academic year of the departments in Cambridge begins on this date.



MAIN BUILDING OF BUSSEY INSTITUTION

ADMINISTRATION BUILDING OF ARNOLD ARBORETUM

TABLE OF CONTENTS

PAGE

Faculty of the Bussey Institution 6

General Statement 7

Requirements for Admission 8

Degrees 8

Academic Year: Fall, Spring, and Summer Terms . . . 8

Registration 9

Research Departments:

- Economic Entomology 10
- Animal Genetics 14
- Plant Genetics 15
- Dendrology 17
- Silviculture and Forest Management 18
- Physiological Plant Anatomy 23
- Economic Botany 24

General Seminar 25

Library Facilities 25

History of the Bussey Institution 26

The Arnold Arboretum 26

The Harvard Forest 28

Bond Requirements 30

Tuition 31

The Bussey Dormitory 31

Living Arrangements at Petersham, Harvard Forest . 31

Scholarships and Fellowships 32

FACULTY OF THE BUSSEY INSTITUTION

Abbott Lawrence Lowell, LL.B., LL.D., Ph.D., *President.*
17 Quincy St., Cambridge.

William Morton Wheeler, Ph.D., S.D., *Dean* and *Professor of Economic Entomology.* 34 Alveston St., Jamaica Plain.

John George Jack, *Assistant Professor of Dendrology.*
East Walpole.

George Howard Parker, S.D., *Professor of Zoölogy.*
16 Berkeley St., Cambridge.

William Ernest Castle, Ph.D., *Professor of Zoölogy.*
Bussey Institution.

Winthrop John Vanleuven Osterhout, Ph.D., *Professor of Botany.* 60 Buckingham St., Cambridge.

Ernest Edward Tyzzer, A.M., M.D., *George Fabyan Professor of Comparative Pathology.* 41 Fairmount Ave., Wakefield.

Oakes Ames, A.M., *Assistant Professor of Botany,* and *Director of the Botanic Garden.* North Easton.

Richard Thornton Fisher, A.B., M.F., *Assistant Professor of Forestry* and *Director of the Harvard Forest.*
87 Mt. Vernon St., Boston.

Edward Murray East, S.M., Ph.D., *Professor of Experimental Plant Morphology.* 87 Robinwood Ave., Jamaica Plain.

Charles Thomas Brues, S.M., *Assistant Professor of Economic Entomology.* 43 Hampstead Road, Jamaica Plain.

Irving Widmer Bailey, A.B., M.F., *Secretary* and *Assistant Professor of Forestry.* 42 Shepard St., Cambridge.

For general information address the Secretary, Bussey Institution, Forest Hills, Boston, Mass.

GENERAL STATEMENT

The purpose of the Bussey Institution is to provide opportunities and facilities for the investigation of those principles and problems which underlie the practical applications of zoölogy and botany to human welfare, and to train advanced students for research along these lines.

At present, emphasis is placed upon the study of the morphology, physiology, distribution, and behavior of insects; the laws of heredity and variation in animals and plants; the principles of dendrology, silviculture, and forest management; the effects of environment upon the form, structure, and distribution of vascular plants; and the economic products of the vegetable kingdom and the species that yield them. In coöperation with the School of Tropical Medicine, provision has also been made for medical entomology and the study of the poisonous plants of tropical countries.

Owing to its organization and facilities for coöperation with other departments of the university and neighboring research laboratories, the Bussey Institution offers the advanced student unusual opportunities for instruction and research. It adjoins the Arnold Arboretum, with its library of thirty thousand volumes, herbarium, and large collections of living plants, and is near enough to Cambridge and Boston so that numerous libraries, and the extensive collections of the Gray Herbarium, Botanic Garden, University Museum, and Museum of Comparative Zoölogy are accessible, and of much value in the study of problems which have a taxonomic or bibliographical bearing. The Harvard Forest at Petersham affords excellent facilities for the study of silviculture, forest management, and forest entomology. Particularly instructive to the economic entomologist is the work of the Federal Parasitological Laboratory at Melrose which enables the student to acquire an intimate knowledge of an extensive experiment in the suppression of injurious insects. The departments of biology, geology, chemistry, physics, and philosophy in Cambridge and the Medical School enable the research student to secure instruction and advice which are frequently of much value in a consideration of certain phases of their problems.

Special attention is called to the fact that the Bussey Institution is open throughout the year, and, therefore, affords a much needed opportunity, *especially during the summer months*, for investigators from other parts of the country, to begin or complete the study of problems that require unusual library or museum facilities, or such encouragement as can be offered by the members of the Bussey staff.

REQUIREMENTS FOR ADMISSION

Admission to the Bussey Institution is granted to graduates of Colleges and Scientific Schools of good standing who present satisfactory evidence of character and qualifications. In exceptional cases other persons of suitable age and equivalent attainments may also be admitted by special vote of the Faculty in each case. Application for admission may be made by correspondence or at the office of the Institution. Admission to the Bussey Institution does not imply admission to candidacy for a degree.

DEGREES

The degrees conferred are the Master of Science, Master of Forestry, and the Doctor of Science. No degree is granted except upon the completion with credit of at least two full terms' work. In the case of the degrees of Master of Science and Master of Forestry, two consecutive terms of residence are usually required and the student must attain grade A or B in at least four full courses or their equivalent.

Students who are not candidates for a degree may register for special instruction and research at any time during the academic year.

At registration, or within two days thereafter, every student of the School is required to submit to the Dean his list of elective studies for approval and then to file this list, countersigned by the Dean, at the office of the School. Any subsequent change in this list of studies must be similarly approved and filed.

Candidates for the Master's degree in Science or Forestry and that of Doctor of Science must, at the beginning of their work, submit their program of study for the approval of the Dean.

ACADEMIC YEAR

The academic year is divided into three terms: a *fall-winter term*, from the Monday preceding the last Wednesday in September to the second Sunday in February; a *spring term*, from the Monday following the second Sunday in February to the second Sunday in June, and a *summer term*, from the Monday following the second Sunday in June to the Sunday following the last Wednesday in September.

REGISTRATION

Applicants for admission are expected to be present in Forest Hills at the beginning of one of the three terms of the academic year, and to register by filling a registration blank and filing it at the office of the school.

On registering, a student receives a certificate of registration from the officer in charge; this certificate he must present to the Bursar, when he files his bond or gives other satisfactory security for the payment of dues incurred during his term of residence. He will obtain from the Bursar authorization to attend instruction and to use the University Libraries.

A student who withdraws from the school in the course of an academic year is required to give immediate written notice at the office of the school. No deduction from the full term's fees will be made in the case of a student who withdraws during the term unless he gives this notice.

DEPARTMENTS OF THE INSTITUTION

ECONOMIC ENTOMOLOGY

Economic entomology was the first subject established at the Bussey Institution because of an appreciation on the part of the University authorities of the usefulness to which this science has attained in our modern commonwealths and particularly its importance in the economics of Massachusetts. Notwithstanding the grave local needs it is not the purpose of the University to duplicate the work being undertaken in many state and federal entomological laboratories throughout our country, but to supplement and extend this work by laying great stress on the investigation of those principles and problems which underlie the practical applications of the science.

The Bussey Institution offers unusual opportunities for experimental and field work of the most varied character. It has at its disposal several large tracts of land, including the Harvard Forest, and it is near the Arnold Arboretum. The laboratory has been equipped with the necessary microscopic, microphotographic, and chemical apparatus, with an insectary, and with cages and other appliances for use in the study of the life-histories and behavior of insects. In addition to the Institution's working library and collections, which are steadily growing, students engaged in investigation have access to the books and collections of the Museum of Comparative Zoölogy of the University and of the Boston Society of Natural History,—institutions which offer exceptional facilities for entomological investigation.

In addition to these aids the student who is taking up applied entomology as a life work, has at his command a wealth of other resources which contribute greatly to broaden his interest in his chosen field. The Departments of Zoölogy, Botany, and Philosophy at Cambridge offer a large number of courses on subjects vitally connected with entomology. To mention only a few of these, there are in the Zoölogical Department thorough courses in comparative anatomy, cytology, embryology, and the sensory reactions of animals, and in the Philosophical Department several courses in comparative psychology which are essential to a scholarly understanding of insect structure and behavior. The Gray Herbarium, Arnold Arboretum and Botanic Garden afford inexhaustible opportunities to the student who is alive to the intimate connection between insect activities and plant life. The establishment of a School of Tropical Medicine at the Harvard Medical School offers unusual facilities for study in medical zoölogy and allied branches. The course in medical entomology is given at the Bussey Institution during February and March.

Still other resources are furnished by the Federal Parasitological Laboratory at North Melrose, an institution for the study of practical methods of controlling the depredations of the gypsy and browntail moths. Through coöperation with the workers in this laboratory the Bussey Institution is able to bring the student into close touch with one of the greatest and most interesting experiments that has ever been undertaken in man's warfare with injurious insects. The Cambridge Entomological Club, which has its headquarters at the Bussey Institution, enables the student to establish personal relations with the working entomologists of New England and to profit by an intimate acquaintance with the work of numerous specialists in his chosen field.

Although the main object of the Bussey Institution is research, it is not deemed advisable to dispense with all formal lectures and laboratory work. Several courses are therefore given for the purpose of providing both preliminary training in economic entomology and an acquaintance with the methods and aims of entomological science in general.

The following is a conspectus of the entomological courses at present offered by the Institution.

Zoölogy *7a* ²*hf*. Morphology and Classification of Insects. — Lectures, laboratory work, and demonstrations. *Half-course (spring term)*. Two lectures and three hours laboratory work weekly; *hours to be arranged with instructors*. Lectures and laboratory work at the Bussey Institution. Professor Wheeler and Asst. Professor Brues.

Course *7a* is open to students who have an elementary knowledge of Biology.

This half-course is designed to cover the leading facts in insect anatomy, histology, embryology, and classification, and forms a basis for all subsequent work in entomology.

Zoölogy 7*b* ^{2}*hf*. Habits and Distribution of Insects. — Lectures, laboratory and field work. *Half-course (spring term)*. Two lectures and a day of field or laboratory work. *Hours to be arranged with the instructors*. Lectures and laboratory work at the Bussey Institution. Professor Wheeler and Asst. Professor Brues.

Course 7*b* is open to students who have had Zoölogy 7*a* or an equivalent.

The work in this half-course is properly a continuation of the preceding. It deals with the activities or ethology of insects, and includes a consideration of such subjects as the tropisms and instincts, protective resemblance and mimicry, the constitution and development of insect societies, geographical distribution, parasitism and symbiosis. As this half-course comes at a most favorable season of the year, work in the field is substituted, so far as practicable, for that in the laboratory.

Zoölogy 7*c* ^{2}*hf*. Practical Entomology. — Lectures and laboratory work. *Half-course (spring term)*. Two lectures and three hours of laboratory work each week. *Hours to be arranged with the instructor*. Lectures and laboratory work at the Bussey Institution. Asst. Professor Brues.

Course 7*c* is open to students who have an elementary knowledge of Biology.

This half-course deals with insects in their practical relation to agriculture, horticulture and arboriculture, and with their activities in the spread of human and animal diseases. Life histories of a selected series of injurious insects are presented, with a study of the most approved methods of controlling and combating them. Students already well acquainted with applied entomology may devote the laboratory time in this course to the investigation of some practical problem.

Zoölogy 18 (Medicine 706). Tropical Entomology. Lectures, laboratory work and demonstrations. *Half-course (February and March). Three two-hour periods a week during February and March. Hours to be announced later*. Professor Wheeler and Asst. Professor Brues.

This course will consist of a few general lectures on the structure and classification of the Arthropoda, followed by a more detailed account of the Arthropoda known to be concerned and likely to be concerned in the transmission of human and animal diseases or in the infliction of local injuries and physiological disturbances. Laboratory work and demonstrations will also constitute an important feature of the courses and will provide for training in the dissection of insects, in the principal methods of studying their life histories and habits, and in their identification by means of dichotomic tables and from technical descriptions. The student will be provided with a list of most useful monographs and reference books on blood-sucking and disease-disseminating arthropoda and should acquire an extensive acquaintance with this literature.

The following groups will be considered:

1. Insecta, with particular reference to the Diptera, Suctoria, Siphunculata, Hemiptera, Hymenoptera, and Lepidoptera.
2. Myriapoda, including the Scolopendridæ.
3. Arachnida, including the Scorpionidea, Araneina, and Acari.

Zoölogy 20*f*. Research in Economic Entomology. Professor Wheeler and Asst. Professor Brues.

This course is designed for those only who are competent to carry on original investigation in economic entomology either in the field or in the laboratory. The finished investigations embodying new facts or methods or new points of view are published as " Contributions from the Entomological Laboratory of the Bussey Institution."

Zoölogy 20*h*. Research in Forest Entomology. Professor Wheeler and Asst. Professor Brues.

There are many practical forestry problems in the United States whose solution must depend to a considerable extent upon the entomologist. Some are quite strictly entomological in their nature, but the majority are such that coöperation between men trained in both forestry and entomology is essential. This course includes no formal lectures and is designed to meet the requirements of students wishing to undertake advanced work on some special problem relating to forest entomology as a preparation for professional work in that field.

Entomological Seminar

A seminar is conducted weekly by the instructors and research students to afford an opportunity for reading and discussing recent publications and for presenting the results of investigations at the Bussey Institution.

ANIMAL GENETICS

The work in animal breeding had its beginnings in a series of experimental studies of heredity begun in the Zoölogical Laboratories of Harvard University in the year 1900. The theoretical importance of these studies was early recognized by the Carnegie Institution of Washington, which made an annual grant toward their support, which still continues. The authorities of Harvard University recognized that such work had important practical as well as theoretical aspects, because of its intimate relation to agriculture, and incorporated it in the program of the Bussey Institution. Here the facilities for the work have been largely increased, partly by larger material resources, partly by lessened demands for formal instruction, which allows more time for research.

The rooms in the main building devoted primarily to work in animal breeding are found on the first floor and in the basement. With a detached animal house heated from the greenhouse heating plant they afford good facilities for the breeding and study of small mammals.

FOR GRADUATES AND UNDERGRADUATES

Zoölogy 8 [1]*hf*. Genetics and Eugenics. The reproduction of animals; the origin of new races; the influence of heredity and environment; applications to animal breeding and human society. Lectures, reading and conferences; or lectures and laboratory work. *Half-course (fall-winter term). Mon., Wed., Fri., at 9.* Professor W. E. CASTLE and Mr. L. C. DUNN.

This course, when taken without laboratory work, is open to students who have an elementary knowledge of biology; when taken as a laboratory course the previous consent of the instructor must be obtained. The laboratory work will consist of breeding experiments with rapidly reproducing animals and will occupy from four to six hours a week. Only a limited number of students can be provided with laboratory work and preference will be given to students specializing in biology.

PRIMARILY FOR GRADUATES

*Zoölogy 10[1]. Genetics (advanced course). *Half-course (first half-year).* Professor CASTLE.

This course will be conducted as a seminar for the critical study of the original publications on which the foundations of genetics rest and for review and discussion of current literature on genetics. A laboratory study of some breeding problem, or a thesis, will be expected from each student. This course is open to those only who have taken Zoölogy 8 with laboratory work or who have taken Botany 11, or who have had equivalent training.

Zoölogy 20*d*. Research in Variation, Heredity, and the Principles of Animal Breeding. Professor W. E. Castle.

PLANT GENETICS

After the work in animal genetics had been established for some time it was manifest that there were many genetic problems which, no matter how great their interest to the zoölogist, were better attacked from the botanical side. Work in plant genetics was therefore established. The general problems under investigation are naturally similar to those of animal genetics. The technique in carrying out such research is, however, quite different, and the general facilities for work are additional to those for work upon animals.

The ample and substantial greenhouses in which the temperature is efficiently controlled by a system of hot-water heating furnish places for starting plants for summer work, for breeding small plants during the winter, and for studying the problems of plant physiology which have a direct relationship to the genetic investigations in progress. The greenhouses are well provided with the various pieces of apparatus needed for such work; but when particular researches demand special facilities, these are obtained.

The lands of the Bussey Institution are so situated that breeding work may be carried out in the summer time upon plants that demand very different environments. The Bussey farm contains fields of the peaty soils of swamp marshes, of the silt loam of the heavier type of agricultural soil and of the sandy loam characteristic of the lighter New England farm soils. Immediately surrounding the main laboratory building there are about two acres with a sandy loam type of soil, which are kept in a high state of fertility by artificial fertilization, upon which plants requiring very rich soil may be grown successfully.

Contiguous to the Bussey Institution is the Arnold Arboretum of 220 acres where students have the opportunity of studying one of the largest collections of trees and shrubs in the world. The living collections here are supplemented by an herbarium, a museum and a library. At the University Botanic Garden in Cambridge is found a large collection of living herbaceous plants, while at the Gray Herbarium on the same grounds the student has access to 400,000 sheets of mounted specimens of the vascular plants.

This illustrates the resources for actual breeding work and the study of the plants under investigation and their relatives as units. In addition there are laboratories on the second floor and private research rooms on the third floor of the main building fitted out for work upon the internal anatomy and morphology of the plants under investigation.

In the library are found the books and journals generally necessary for constant reference. In addition complete sets of rare serials and other books are found in the general library of Harvard College and in the libraries of the University Museum, the Gray Herbarium, and the Arnold Arboretum. Many exceedingly rare publications will also be found in the libraries of the Boston Society of Natural History and of the Massachusetts Horticultural Society.

*Botany 11 [2]*hf.* The Principles of Genetics. Lectures and laboratory work. *Half-course (spring term). Mon., Wed., and (at the pleasure of the instructor) Fri., at 11.* Professor EAST and an assistant.

Course 11 is open to those students only who have an elementary knowledge of Biology, Mathematics and Chemistry. It is a second course in Genetics, more technical in character than Zoölogy 8, and is designed to give the general biological student acquaintance at first hand with the principles, the methods and the problems of Genetics in their application to the Theory of Organic Evolution and to the improvement of plants and animals and to prepare the student specializing in Genetics for research. For the student not specializing in biology, Zoölogy 8 is recommended.

PRIMARILY FOR GRADUATES

*Botany 12 [2]*hf.* Selected Topics in Genetics. A thesis may be substituted for laboratory work. *Half-course (spring term). Days and hours to be arranged.* Professor EAST.

Detailed studies are made of special topics in Genetics, such as internal causes of variation primarily affecting the individual, external influences affecting variation, the transmission of modifications due to external influences, special types of inheritance, genetics in its relation to chemistry, the bearing of cytological work on genetics, the meaning and use of statistical methods, the study of different systems of plant breeding, etc. In the laboratory or thesis work students are assigned special problems.

This course is open to those students only who have taken Course 11, or an equivalent.

Botany 20*f*. Research in Plant Genetics. Professor EAST.

Work in Course 20*f* is carried on at the Bussey Institution, Jamaica Plain. The academic year for the course extends from the beginning of the spring term until the beginning of the fall-winter term, but arrangements can generally be made whereby work may be carried on throughout the calendar year.

This course is conducted under the Faculty of the Bussey Institution, but by special arrangement may be taken by students in the Graduate School of Arts and Sciences.

DENDROLOGY

Students wishing to take advanced work in dendrology have the advantage of the very great facilities offered by the Arnold Arboretum in its living collections, its herbarium and library. As no other existing herbarium so well represents the North American ligneous flora, either in number of species or in their variation and geographical range, as the living collection of hardy trees and shrubs is not excelled in North America, and as the library is very complete in books relating to dendrology, forestry and arboriculture, advanced students or specialists have here an unusual opportunity for research and monographic work. The living collections of the Arboretum are supplemented by those of the nearby parks of the City of Boston. The very large and comprehensive herbarium and library of the Gray Herbarium of Harvard University at Cambridge are always available for students, while additional opportunities for reference and study are offered in the libraries of the Massachusetts Horticultural Society, and other institutions in Boston and Cambridge.

The herbarium and library of the Arnold Arboretum are intended to illustrate the ligneous flora of all parts of the globe. Thus students have a wide range of material for study and research. They may elect to study the North American forest flora, or some portion of it in detail in its economic aspects, or from a taxonomic standpoint alone, involving a comprehensive survey or investigation or monograph work; or they may give attention to exotic subjects which have a bearing on forestry problems or dendrology. As the forests of the West Indies, Mexico, Central and South America, and of the Philippines are steadily commanding more attention, students contemplating work in these regions will need to gain an intelligent conception of the elements of their forest floras, and of studying and classifying material collected in them.

The very extensive collections of the ligneous flora of China and Japan in the herbarium of the Arboretum offer unexcelled opportunity for specialists in these interesting floras, either from the standpoint of systematic forest botany or comparative dendrology. Nowhere else, for instance, could the student of forestry find material brought together which so well and fully illustrate the varied oriental forest flora.

Specialists in wood technology, or forest entomology, may coördinate their work by gaining familarity with the botanical characters, variations, distributions, and so forth, of the forest trees, the woods of which they are investigating or which act as hosts to the insects, or other diseases affecting them.

Forestry 20*a*. Research in Dendrology. Asst. Professor Jack.

Study of native and exotic trees and other woody plants adapted to the temperate regions of the United States, including seminal and other variations under varying geographic or ecologic conditions.

Systematic study of the ligneous flora of North America as a whole, or of particular regions in North America.

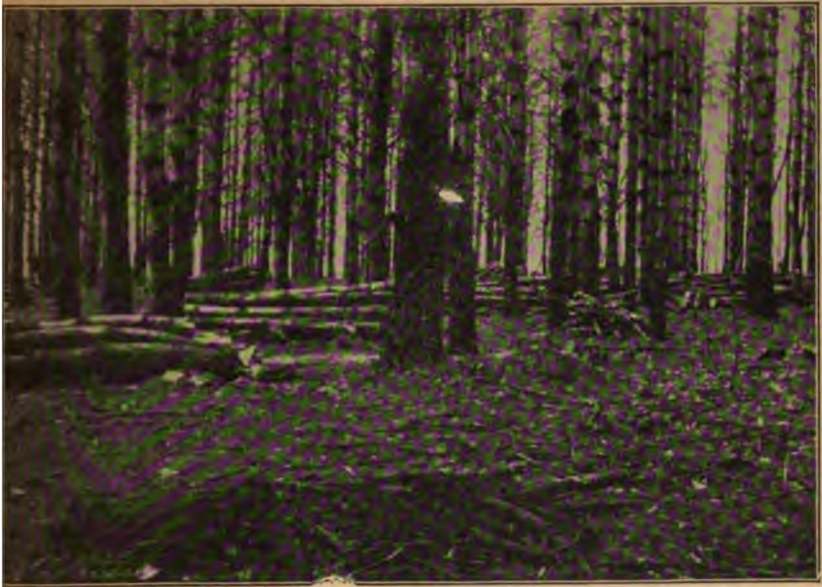
Study of subtropical and tropical forest floras.

Dendrology of special groups.

SILVICULTURE AND FOREST MANAGEMENT

Instruction in this field takes the form of specialization through research or practical problems. It is intended primarily for men who have already had elementary training in forestry or equivalent preparation through other scientific or professional work. The training centres on the Harvard Forest in Petersham, Massachusetts, which, owing to its location on the borders of distinct forest regions, its variety of forest conditions, its accessibility to ready markets, and in particular to the intensiveness of its management, provides exceptional opportunities for advanced study of several groups of problems underlying the application of forestry.

Only in limited areas in America do present economic conditions permit the management of forests for continuous wood production



A Thinning in a White Pine Stand 45 years old. Logs have been piled for hauling, cordwood has been cut from the tops, and the remaining slash has been burned.

Compartment 5, Meadow Water Tract

Sawmill and Mill Yard

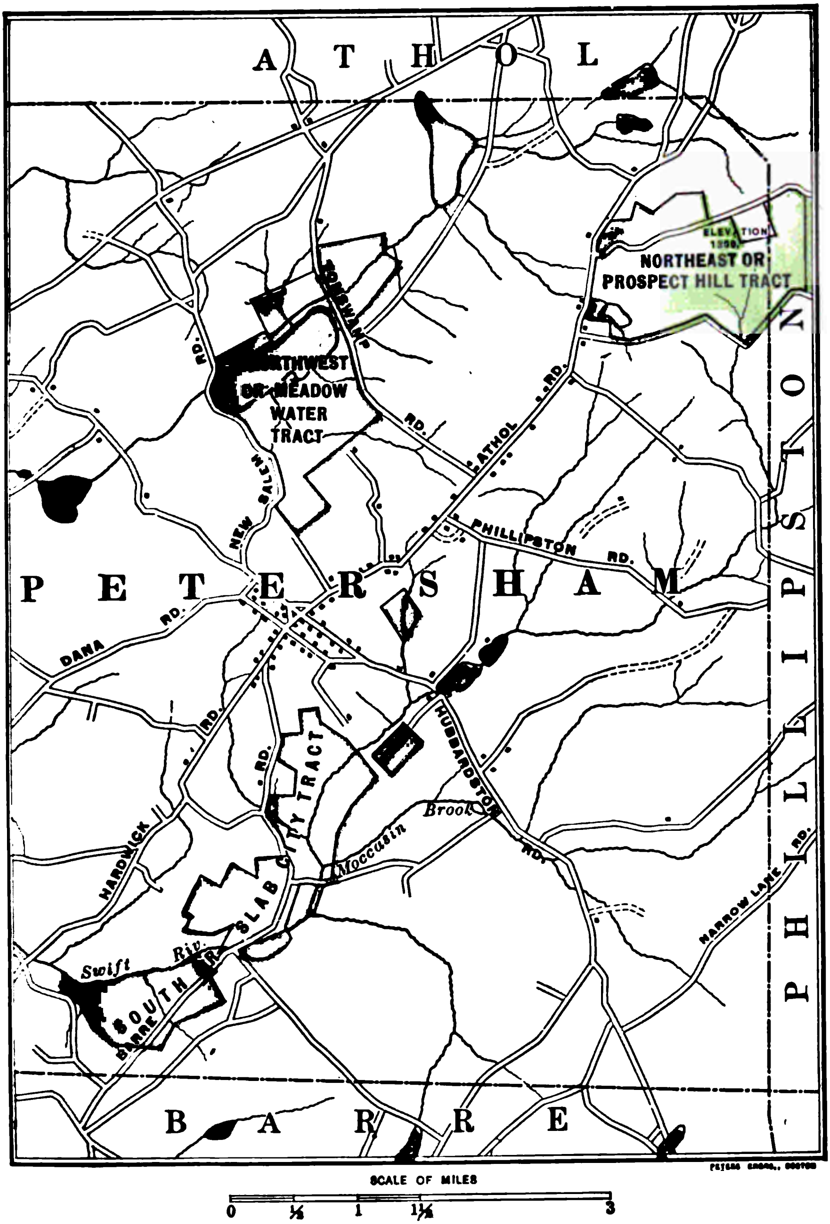
Meadow Water Tract

alone. The Harvard Forest has been under management on this basis since 1908, and it presents both in its own silvicultural conditions and in its relation to its commercial surroundings, an almost unique combination of the factors underlying the practice of intensive forestry, especially those leading to close utilization. Chief among these factors are a dense regional population, adequate transportation, and the presence of varied local wood-working industries. Inasmuch as similar conditions are developing in other forest regions in the country, a detailed understanding of their effects on the management of forests is increasingly valuable. With the business administration of the Forest to work from, the student may thus investigate to great advantage special problems underlying management.

Of equally broad application is the training offered in the research upon which the practical use of silviculture is based. The past and present cuttings, plantations, and other work on the Forest, and the research conducted by the instructors, furnish demonstrations which the student may study in preparation for undertaking original investigations under direction. An understanding of the aims and methods of research in silviculture and forest measurements is highly useful in whatever region a man intends to work, since the methods and conditions which control the application of results are often alike on widely separated forests. On the Harvard Forest the character of the management makes it feasible to conduct investigations and to test results on a scale which would be rarely possible elsewhere, while the low fire hazard and permanency of policy safeguard those experiments which require time for the development of conclusions.

Forestry in America has hardly made a beginning in fundamental silvical science — the knowledge of the exact laws governing the reproduction and growth of stands, and the interactions of the soil and the treatment of the forest cover. To men with suitable preliminary education and thorough technical training, this field offers unusual opportunities for useful work. For those who wish to specialize in problems of this sort, the field work on the Forest is supplemented by the libraries of the Bussey Institution and the Arnold Arboretum.

There are also types of forest problems, many of them now highly important, in the study of which combination between two or more sciences is necessary. The student whose special purpose requires it may devote as much of his time as is needed to collateral work in Entomology, Dendrology, or Plant Anatomy under Asst. Professor


ATHOL
PETERSHAM
PHILLIPSTON
BARRE
NORTHEAST OR PROSPECT HILL TRACT
ELEVATION 1299.
NORTHWEST OR MEADOW WATER TRACT
TOMBLIN
RD.
NEW SALEM RD.
ATHOL RD.
PHILLIPSTON RD.
DANA RD.
RD.
RD.
HARDWICK RD.
SLAB CITY TRACT
HUBBARDSTON RD.
Moccasin Brook
NARROW LANE RD.
Swift Riv.
SOUTH TR.
BARRE RD.
PETERS ENGR. CO., BOSTON
SCALE OF MILES
0
½
1
1½
3

Brues, Jack, or Bailey. In the same way men studying in these latter fields may secure such work as they need on the Harvard Forest.

In addition to these lines of specialization, training is offered in the operation of a forest typical of New England white pine and hardwood regions. Such a study is especially adapted for men who desire to fit themselves for the handling of woodlands where similar conditions prevail. Instruction under this head covers in general the business of portable mill lumbering, from the planning of the cutting to the marketing of the product. It would not in itself constitute a study sufficient for a degree, but would have to be supplemented by work of a broader character.

Principles of Forestry. *Half-course (fall-winter term.) Tu., Th., Sat., at 11, and one half-day a week field work.* Asst. Professors Fisher and Jack.

The purpose of this course is to give men intending to enter the lumber business an understanding of the aims and importance of applied forestry, and of the general methods governing its practice. Such an understanding should underlie intelligent coöperation with the development of forestry in the future. The general outline of the course is a summary of technical forestry: the chief species of American trees and their identification; the biological and other natural laws controlling the life of the forest and its influence on its surroundings; and the principles underlying the practice of forestry as an art and a business.

A survey of so large a field will necessarily be general, but many topics of peculiar interest and importance to men having to do with large timberland ownership will be fully developed. What are the most practicable methods of reproducing forests, and to what extent can they be profitably applied by a business concern? What, as a matter of established fact, is the effect of forests upon the distribution of surface and ground water, and hence upon stream flow? How does fire affect present and future conditions in the forest, and what are the most effective means of protection against it? What is the comparative efficiency and accuracy of the chief methods of measuring and valuing timberlands? What are the principles governing the legislative action of towns, states, and the Federal Government in respect to forests? The forest is vitally related to the perpetuation of industry, not alone through its production of wood, and it is an understanding of the nature of this relationship that the course aims to give.

The field work of the course is conducted both at the Arnold Arboretum and in tracts of woodland under management accessible to Cambridge.

Forestry 20*b*. Research in Silviculture and Forest Management. Asst. Professor FISHER.

PHYSIOLOGICAL PLANT ANATOMY

Research in plant anatomy at the Bussey Institution deals with the effects of environment upon the form, structure, and distribution of the higher vascular plants. The work has an important bearing, not only upon the study of classification and phylogeny and certain problems of geology, but also upon problems of applied biology, such as agriculture, horticulture and forestry. Since much emphasis is placed upon the internal structure of plants, the Laboratory of Plant Anatomy is provided with extensive collections of plant tissues from various parts of the temperate and tropical zones, and a complete outfit of efficient modern apparatus for the preparation of structural material for microscopic examination and photomicrography. The large collections of living plants in the Arnold Arboretum, the Harvard Forest, a forest experiment station of 2000 acres, and the large libraries and herbaria of the Arnold Arboretum and Gray Herbarium are available for the research student in plant ecology.

Applied Botany 20*b*. The effects of environment upon the form, structure, and distribution of vascular plants. Asst. Professor BAILEY.

In the research work in this course emphasis may be placed upon the geographical distribution of selected types of structures, the effect of environment upon the form and structure of particular groups of plants, or the functional significance of different types of growth forms or structural designs. Although concerned primarily with the effects of environment upon plants, considerable attention will be given to historical factors and the comparative anatomy and phylogeny of Gymnosperms and Angiosperms. The study of specific economic problems may be undertaken by the student when he has become thoroughly familiar with the necessary theoretical aspects of the subject.

Forestry 20c. Structure and Properties of Economic woods. Asst. Professor BAILEY.

The research work in this course deals with the study of the structure and natural functions of ligneous tissues with the object of securing information that bears directly or indirectly upon some one of the many difficulties that confront the users of forest products. For example, the fundamental factors that control the seasoning of wood, its preservative treatment, decay, maceration, and conversion into various derivatives are at present imperfectly understood. The anatomical structure of wood has an important bearing upon the determination and study of these factors. Again, no successful method has yet been devised for the identification and classification of commercial woods. The study of the structure of woody tissues and their variation under the influence of different environments or growth conditions must ultimately be of assistance in the solution of this difficulty.

The research student will often find it desirable to combine the advanced training given in plant anatomy with that in plant genetics and dendrology. Those who desire a more thorough general training may secure necessary instruction in chemistry, physics, geology, climatology, biology, etc., in the Faculty of Arts and Sciences.

ECONOMIC BOTANY

The work in this department is planned to familiarize the student with the more important economic products of the vegetable kingdom and the species that yield them. In the general survey of the subject special emphasis will be placed on the classification of useful plants, their origin and geographical distribution. This course of study is primarily offered to meet the requirements of the applied biologist who wishes to acquire a knowledge of the affinities and alliances of those plants that come within the scope of his work and who recognizes the necessity for a broad conception of the fundamentals of modern systematic botany in its application to horticulture, agriculture and commerce. Opportunity will be given for specialization in those branches of the subject that properly come within the province of economic botany, including the study of poison yielding plants, drugs and foods.

Facilities for the examination, propagation and study of living specimens may be had at the Botanic Garden in Cambridge, where a representative assemblage of plants is cultivated. At the University

Museum an extensive collection of vegetable products and models, that will be accessible to properly qualified students, is available for comparative studies and reference.

*Botany 15. Outlines of Economic Botany. Lectures, laboratory work and demonstrations. *Half-course (spring term). Hours to be arranged.* Lectures and laboratory work at the Bussey Institution. Demonstrations in part at the Botanic Garden and University Museum. Asst. Professor Ames.

This course will consist of lectures on the aims and purposes of economic botany with special reference to the more important plants that yield commercial products. Laboratory work and demonstrations constitute an important part of the course and will be devoted to a study of classification in general with particular regard to economic plants and their allies.

GENERAL SEMINAR

Once a month a general seminar attended by all the staff and students of the Bussey Institution is held. At these meetings topics of general scientific interest are brought up for consideration and discussion.

LIBRARY FACILITIES

The Bussey Institution has a library of some 3300 volumes and 16,000 pamphlets, devoted mainly to works on agriculture, and to the subjects that now form the special field of instruction. This library is supplemented by that of the Arnold Arboretum which contains 37,000 volumes and pamphlets relating to dendrology, forestry, general descriptive botany, and the cultivation of trees. The two libraries possess a very complete list of biological periodicals and publications of zoölogical and botanical societies.

The college and departmental libraries in Cambridge contain 1,700,000 volumes and phamphlets. Of these, the library of the Gray Herbarium relating to systematic botany, that of the Museum of Comparative Zoölogy relating to zoölogy and geology, and those of the various botanical laboratories are the most valuable to the research student in biology.

In Boston, the large Boston Public Library, and the libraries of the Boston Society of Natural History, Mass. Horticultural Society and Harvard Medical School are extremely valuable reference libraries for the biological investigator.

HISTORY OF THE BUSSEY INSTITUTION

The Bussey Institution was established as a department in Harvard University under the trust created by the will of Mr. Benjamin Bussey. This will, drawn in 1835, provided for a school of agriculture and horticulture. Anticipating by more than twenty-five years the Morrill Act in Congress, establishing the State Agriculture Colleges, this will was remarkable for its foresight of what has been one of the most important of recent educational and scientific developments in the country. It was further noteworthy in that the legacy thus coming to the University was not merely the largest which had been received, but was not surpassed for many years. Mr. Bussey died in 1842; the funds became available in 1861 and the Institution began work in 1871. In addition to endowment the University received from Mr. Bussey a tract of 394 acres of land, beautifully situated within what are now the limits of the City of Boston, in appearance and in effect a part of the great Metropolitan Park System. A further generous endowment from Mr. James Arnold in 1872 enabled the University to develop a part of this land, some 220 acres, so that it ranks in beauty and scientific value among the great arboretums of the world.

The Bussey Institution from its foundation in 1871 until the spring of 1908 was an undergraduate school of agriculture. During this period the various state agricultural institutions rose to the possibilities of their purpose, and, in view of their greater service, the Bussey Institution was reorganized so as to undertake only graduate instruction and research. In thus handling the problems of applied biology it could better avail itself of the other scientific resources of the University, the Departments of Botany and Zoölogy, the Museums, and Gardens. The reorganization has been complete, in that an entirely new staff has been appointed, and through the generous gifts of gentlemen interested in the furthering of these sciences, the building, grounds, instrumental equipment, and the special library have been entirely readapted to the new purpose.

THE ARNOLD ARBORETUM

The Arnold Arboretum includes about two hundred and twenty acres of land, most of which formally belonged to the Bussey Institution of Harvard University, but has since been dedicated by the University (in 1872 and 1896) to the formation of a collection or museum of living trees and other woody plants adapted to the climate of New

England, or the northern parts of North America. Here have been conducted in the past and here are still in experimental stages many tests in acclimatization.

At present these living collections contain approximately three hundred genera and about five thousand species and varieties or forms of trees and shrubs, which will grow in cool temperate climates. They are mainly arranged in groups according to botanical relationship and are available for study at all times of the year. For convenient comparison and popular use there is a fruticetum, or collection of shrubs, arranged together in botanical sequence and containing about one thousand species and varieties or forms. There are also numerous supplementary collections of shrubs arranged in various parts of the Arboretum.

The nurseries contain many species under test for hardiness or other qualities which would render them economically valuable for cultivation in this country, either horticulturally or silviculturally.

Besides the living outdoor collections there is a small propagating house where propagating by different methods is carried on for the purpose of increasing the collections or as tests.

The herbarium, and library, and general offices of the Arboretum are quartered in a fire-proof building at its northeastern extremity. The herbarium was first largely augmented by collections of specimens procured in getting data and material for the Tenth Census (1880) and the Jesup Collection of North American Woods for the American Museum of Natural History.

The later preparation and publication of the *Silva of North America* necessitated the further accumulation of a great amount of material from all parts of the country, and this has yearly been greatly increased by the collections of many botanists in expeditions to regions which have not been well explored. Various expeditions to China and Japan, with their floras showing close relationships with the flora of North America, have made the Arboretum herbarium first in importance in displaying the dendrological riches of these oriental countries.

Altogether, through its own collectors or by purchase or exchange with other scientific institutions, the Arboretum has now an herbarium of about one hundred and ten thousand mounted specimens. There is also open to general view a collection of specimens of the woods of North American trees.

The library contains approximately thirty thousand bound volumes relating to dendrology, forestry and arboriculture. In these subjects it is not equalled by any other in America, and students or specialists taking advanced work in the study of woody plants have facilities offered in this great library which cannot be found elsewhere.

THE HARVARD FOREST

The Harvard Forest was acquired in the autumn of 1907 through the generosity of Mr. John S. Ames, of North Easton, Mass., of the Class of 1901, who gave the money necessary for its purchase and an additional sum for the repair and outfitting of buildings. The land is situated in Petersham, Mass., and about 1800 acres of it were previously owned by Mr. James W. Brooks. In order to perpetuate the forest and render it useful both to the town and the cause of forestry, Mr. Brooks offered it to the University for a price substantially below its estimated sale value. At the same time owners of adjoining land, Messrs. J. J. Higginson, Edwin C. Dexter, Joseph C. Smith, Henry S. Bennett, Charles S. Waldo, and William Simes, and Mr. Brooks himself, offered to give contiguous lots and holdings amounting to between 200 and 300 acres. These gifts simplified the boundaries, secured the approaches, and rounded out the areas to an aggregate of about 2000 acres.

The forest lies on hilly country at an elevation varying from 800 to 1400 feet above sea level. It is divided into three distinct blocks of (about) each 675 acres, which are located, respectively, northeast, northwest, and southeast of the village. The northeast block covers the slopes and surrounding areas of Prospect Hill, the northwest block includes the basin of a small pond called Meadow Water, and the southeast block takes in about two miles of the narrow valley of the Swift River, with a pond and small water power along its course. The total stand of merchantable timber in the forest amounts to about eleven million board feet, nine-tenths of it white pine, and the rest chestnut, white ash, red and white oak and other hard woods. About fifteen miles of good wood road provide access to almost any portion of the tract.

As to species the composition of the forest exemplifies, in consequence of its elevation above sea level and its geographical position, an interesting overlap between types characteristic of the north woods and those prevailing in Southern New England and the Middle States. Besides the white pine stands, which are the most abundant and productive on the tract, occur mixed pine and hardwoods, pure chestnut, mixed hardwoods, beech and hemlock, spruce and hemlock swamps, and a number of temporary types, such as poplar and birch, pure gray birch, and pitch pine. Typical Southern species are tupelo, sassafras, red cedar and shagbark hickory; typical Northern are paper birch, red spruce, larch, and red pine.

The age of the forest ranges from ten years on some recently cut over tracts to one hundred or more years on a few small areas where but little cutting has been done since early times. The greater part of the merchantable stand is from forty to seventy years old.

The primary object in the possession of this Forest is its use as a field laboratory and experiment station. Owing to an unusually fortunate arrangement of age classes in the growing stock, and to excellent market and accessibility, the tract is operated on the principle of a sustained yield. Even at present annual and roughly equal cuts are made; and the amount of these will gradually increase. In adaptability to this intensive handling the Forest is very nearly unique in the United States.

With relation to technical work the property has the following functions: —

First, an experiment station, both for testing methods of forest production and for investigating problems in silviculture and management: To a large extent, the cutting areas of previous years, being under observation and record, form fruitful sources of data on the effects of different kinds of cutting upon the growth and reproduction of the forest. In addition, there have already been established a number of permanent sample plots for the study of such problems as comparative rates of growth of thinned and unthinned stands; relative development and responsiveness of advance growth of different species when released by cuttings; annual growth of selected species; relation of plantations to varying conditions of soil, ground cover, and shade. The Forest maintains a nursery in which, in addition to the species grown for reforesting cut over or blank areas, a number of other commercial trees are raised for experimental purposes. The plantations, both commercial and experimental, now cover an area of about thirty acres, and these are extensively supplemented, for the purpose of observation and comparison, by many others, not only on lands immediately adjacent, but in the neighboring towns. One of the most notable of the many successful forest plantations in Massachusetts is that on the water shed of the Wachusett Reservoir at Clinton, where the Metropolitan Water Board has reforested over twelve hundred acres of vacant land with a stand of exceptional thriftiness and rapidity of growth. The material available from experimental work on the Harvard Forest, and the history of its management, as well as other examples of forest work in the same region, furnish a unique opportunity for men wishing to get special training in silviculture and management, not only with reference to New England conditions, but as bearing upon problems underlying intensive forestry in any part of the country.

Second, an increasingly instructive illustration of how scientific forestry is worked out in practice. The yearly business management, from the cutting to the marketing of the lumber, is controlled and recorded by a thoroughly up-to-date accounting and cost analysis system, such as is used by large companies; and journal and photographic descriptions are made of the silvicultural results of work in the woods, and of the annual changes which occur. In addition, the history of previous cuttings, both technical and financial, is available, so that the character of an organized forest can be more and more clearly understood.

Third, a near and varied market furnishes exceptional opportunity for the study of the relation of utilization to management. In Athol, the adjoining town, are factories manufacturing match blocks, boxes, furniture, sashes and blinds, and toys. These, with a constant demand for railroad ties and for cordwood, make intensive forestry practicable. Taken in connection with the logging and portable sawmill operations on the forest as well as on neighboring tracts, this market offers exceptional chances for the study of problems in the relation of sales and utilization to management. In such a study a man may familiarize himself with an important type of the lumber business, and one which is today peculiarly adapted to the practice of intensive forestry.

BOND REQUIREMENTS

Every resident student must file with the Bursar a bond in the sum of *two hundred dollars*, signed by two bondsmen, one of whom must be a citizen of the United States, or by a surety company duly qualified to do business in Massachusetts, as security for the payment of University bills; or he may deposit with the Bursar two hundred dollars in United States bonds for the same purpose; or he may deposit *fifty dollars* as security and pay in advance all sums for which he shall become liable to the University.

No officer or student of the University is accepted as a bondsman.

TUITION

A tuition fee of one hundred dollars is charged for a full term's work. Students taking less than four half-courses in any term are charged at the rate of twenty-five dollars for each half-course.

All students are required to pay the tuition fee in advance, at the beginning of each term. *No bills are sent specifically for the tuition fee,* which should be paid to the Bursar* on or before the following dates:

Tuition for the fall-winter term	.....	September 23.
" " " spring "	.....	February 11.
" " " summer "	.....	June 10.

A student who is doing less than full work is required to present at the Bursar's office a certificate from the Dean or the Secretary stating the courses that he is taking; and he is not permitted to attend courses that are not included in the certificate.

THE BUSSEY DORMITORY

A large dwelling house situated upon the grounds of the Bussey Institution is maintained as a dormitory for the graduate students. Students living in this dormitory are charged a fee ranging from six dollars to fifteen dollars a month according to the accommodations.

EQUIPMENT AND LIVING ARRANGEMENTS AT PETERSHAM

The headquarters for work at Petersham consist of a large three-story building, the two upper floors of which are divided into bedrooms, and the lower floor of which includes a dining room, two lecture rooms, a library, a living room, and an instrument closet. Adjoining the main house is a wing, and behind this are two barns for horses and cattle, and a storage shed for wagons, sleds, etc. The outfit for work includes all the instruments commonly used in forestry, a complete set of the logging and woods tools used in the region, and such reference books as are needed in connection with the instruction given. In each bedroom is an iron cot with pillow and mattress, a table, two chairs, pails, and a lamp. There is a bathroom with running water on the second floor. A telephone provides communication with the village and with points on long distance lines.

---

* The Bursar's office is in Dane Hall, Harvard Sq., Cambridge. Hours 9–1.

Each man is expected to supply his own bedding and look after his own room. Board is furnished at a reasonable rate. A small charge per month is made to cover rent, the use of furniture, light, and heat.

SCHOLARSHIPS

Anna C. Ames Scholarship	$400

Founded in 1917 by Professor Oakes Ames in memory of his mother, Mrs. Anna C. Ames.

Fellowship in Industrial Botany	$500 (for 3 years)

Founded by the late William Barbour, President of the Linen Thread Company of New York City. For flax investigations.

George H. Emerson Scholarship	$400
University Scholarship	$200
Priscilla Clark Hodges Scholarship	$225

The following Fellowships and Scholarships are available in other Departments of the University as well as in the Bussey Institution:

The Scholarship of the Harvard Club of Chicago; with an income of three hundred dollars. Maintained by the Harvard Club of Chicago; — to be awarded to a graduate of an Illinois university or college who wishes to pursue graduate studies at Harvard University — to be appointed by a committee of the Club.

The Scholarship of the Harvard Club of Nebraska; with an income of one hundred and fifty dollars, — open to a graduate of a Nebraska high school, or Nebraska college or university, during his first year of residence.

The George Foster Peabody Scholarship; with an income of two hundred and fifty dollars — to be used for a "scholarship in the graduate school of Harvard University, the Scholar to be nominated by the Chancellor of the University of Georgia from among the recent graduates of that institution." Not available at present.

The Charles Elliott Perkins Scholarship; with an income of three hundred dollars, — "to be offered each year to a graduate of an Iowa college or university in any of the graduate or professional departments of Harvard University."

The Princeton Fellowship; with a stipend of four hundred and fifty dollars. From a graduate of Princeton University, to be awarded to a graduate of that University studying in any department of Harvard University.

The Scholarship of the Rocky Mountain Harvard Club. Maintained by the Rocky Mountain Club of Denver, Colorado; to be awarded to a promising graduate of a Colorado college or school pursuing his studies at Harvard University; the appointment to be made annually by a committee of the Club.

The James A. Rumrill Graduate Scholarship; with an income of two hundred and twenty-five dollars. This scholarship will be offered each year to a properly qualified graduate of a college or university in Virginia, North Carolina, South Carolina, Florida, Georgia, Tennessee, or Kentucky, who desires to pursue his studies in one of the graduate departments of Harvard University.

The Frederick Sheldon Fund for Travelling Fellowships. The present income of this fund is about fifteen thousand dollars. The income is not to be assigned in scholarships of fixed amounts, but "on recommendation to the Committee from the various Departments and schools, to be assigned as the Committee shall deem most expedient for purposes of investigation or study either in this country — outside of Harvard University — or abroad."

Frederick Sheldon Fellow from the Bussey Institution, 1915–16. — Dr. William M. Mann, Zoölogical Exploration of Fiji and other East Indian Islands.

PROPERTY OF DIVISION OF
FORESTRY
COLLEGE OF AGRICULTURE
UNIVERSITY OF CALIFORNIA

SUPPLEMENT TO
OFFICIAL REGISTER OF HARVARD UNIVERSITY

VOLUME XIV MARCH 29, 1917 NO. 13

Lumber Business

Training offered by the Harvard Graduate School of Business Administration in Coöperation with the Department of Forestry.

FOR men who have had systematic training in the important activities that the lumber business is now being impelled to study, such as marketing and utilization, factory management, scientific cost accounting, and the use of business statistics, the chances for employment and steady advancement are excellent. In the earlier days when timberland was abundant and relatively cheap, lumbering was largely a business of speculation in stumpage, and the rise in the value of the timber often made up the bulk of the profit. Under such conditions the manufacture and distribution of the product did not require the highest efficiency of organization. Meanwhile the supply of timber has become greatly reduced, the business of handling it has become large and complicated, and carrying charges, the costs of labor, materials, and other factors, have gone up rapidly. The result has been that, deprived of the support of cheap stumpage, lumber companies are being compelled to operate on a narrow margin of profit. To secure this profit is more and more plainly a problem of management, of manufacture, including logging and milling, and of distribution, including transportation and selling. Under these circumstances, the problems of wood production, of providing for future supplies of timber, urgent though they are, must still appeal to the capital invested in lumber as secondary to the problems of management.

The realization of this is already widespread, not only among foresters, large numbers of whom have found that it is only in the operating or the business end that they have obtained employment with lumber companies. There are 48,000 sawmills in the United States, not counting many thousand specialized forms of manufacturing which also use wood. The total investment in industries using wood amounts to two and a quarter billion dollars. Chiefly on account of the financial history of timberland ownership and the enormous developments in utilization, these industries are facing the necessity of fundamental readjustments in organization and method. Indeed, the present may be regarded as one of the turning points in the business history of lumbering. Certainly it is recognized by lumbermen as calling for more and more scientific methods within the business and a broader understanding of the economic relations between their own production and that of an ever increasing number of dependent industries. The result is a new opportunity for the man trained in the scientific principles of business as applied to lumbering. This opportunity is to be found not merely in the present desire of lumbermen to employ such men — though that, as in most businesses, is its first indication — but still more in the prospect of ultimate choice among a wide variety of special fields (many of them involving outdoor life) and of having a part in large changes. Besides the openings in established organizations there are opportunities for the man with comparatively small capital to develop a business of his own.

Program of Instruction

Students who are candidates for a degree are required to take the equivalent of eight full courses during the two years. Certain courses are prescribed for all students but others may be elected from the large number described in the Business School catalogue. Certain courses correlate more closely with the work in lumbering, and for that reason are recommended as electives, unless previous training or future plans make other courses more advisable. Any of the elective courses not chosen during the first year may be selected for second-year work. The following are the lists of required and recommended courses: —

FIRST YEAR

Required

Logging and Sawmilling. (Introductory field work.)
Principles of Forestry. (Half-course, first half-year.) [1]
General Lumbering. (Half-course, second half-year.)
Accounting Principles. (Full course, throughout year.)
Marketing. (Full course, throughout year.)
Commercial Contracts. (Full course, throughout year.) [2]

Electives

Factory Management. (Half-course, first half-year.)
Business Statistics. (Half-course, first half-year.)
Investments. (Half-course, second half-year.)
Financial Management of Industrial Corporations. (Half-course, first half-year.)
Accounting Practice. (Half-course, second half-year.)
Railroad Organization. (Half-course, first half-year.)

SUMMER WORK

During the summer following the first year it is desirable that students work in the employ of some lumber company. The work may be in connection with a logging or milling operation, or in some other branch of the business as may be arranged.

---

[1] Required of students who have not had previous training in Forestry.

[2] This course may be taken either during the first or second year.

SECOND YEAR

Required

General Lumbering. (Half-course, first half-year.)
Lumber Problems. (Full course, second half-year.)

Electives

Business Policy. (Full course, throughout year.)
Purchasing. (Half-course, second half-year.)
Retail and Wholesale Store Management. (Half-course, first half-year.)
Factory Management—Second-year course. (Full course, throughout year.)
Industrial Accounting. (Half-course, first half-year.)

Admission

The course is open and recommended not only to college graduates who look forward to some branch of lumbering as a life work, but also to graduates of forestry or engineering schools with whose special training the instruction in the lumber business can very profitably be combined. By permission of the Dean it is also open to men over twenty-one years of age who have had at least three years' consecutive business experience. Such men are classed as special students, and are allowed to take a maximum of two full courses during the first year, and may be permitted by special vote of the Faculty to take more work during the second year.

Degrees

Students in regular standing upon completion of the two years' course receive the degree of Master in Business Administration. Men registered in the Department of Forestry to whom the same instruction is also open, are eligible under similar conditions for the degree of Master of Forestry.

Description of Courses

RELATING DIRECTLY TO LUMBERING

Logging and Sawmilling. (First-year course.) A field study under direction. Assistant Professors FISHER and GRIES, and Mr. FARQUHAR. Conducted during the month preceding the opening of college at a large mill and logging operation in northern New York.

The aim of this work is to provide a concrete and comprehensive acquaintance with the processes and organization of a typical lumber producing concern. The company is operating in hardwoods, with a large timber tract to log over. Its operation and equipment cover every process from the stump to the yard. The company also runs a second mill of a very efficient type. Students will make headquarters at the mill or camps of the company. The instruction will cover both discussion of the planning and organization of the operation as a whole and study of the factors affecting the method and efficiency of each process by itself. In addition to this analysis of the lumbering as such, demonstrations will be given in the woods of standard methods of estimating timber, and visits will be made to some local tracts to which forestry has been successfully applied. It is not expected that the work of this course will take the place of practical experience. Its purpose is primarily to furnish a ground plan of logging and sawmilling, to make a man familiar with the physical processes involved, the ordinary problems, equipment and terminology, and thus to lay the necessary foundation for the more technical and detailed study of the later courses.

General Lumbering. Assistant Professor GRIES. (Half-course, second half-year.)

The purpose of this course is to acquaint the students with conditions in the lumber industry, to give them some knowledge of the operations and processes involved in logging and the manufacture of lumber, and to acquaint them with problems of management connected with timber resources, logging, and manufacture.

After a brief introductory survey of the present status of the industry, the following points are considered: timber resources: — investments in standing timber, conditions necessitating large timber holdings on the part of the manufacturer, problems involved in the financing of such purchases, carrying charges incident to the ownership of a large supply of raw material, and timber estimating; logging: — the natural and economic factors affecting logging, woods labor, woods operations, transportation of logs, and logging methods in different sections of the United States; manufacturing: — factors affecting the selection of a site, size, and equipment of a sawmill, sawing, grading, handling, seasoning, and finishing of lumber, and the character of reports required by managers of typical sawmill plants.

Through the assignments of subjects for study and report, the students receive an introduction to the character of problems in need of investigation and solution in the present and coming development of the lumber business.

Assistant Professor **Bailey** is in charge of the work on wood identification. About twelve lectures are devoted to this work and are supplementary to the regular lectures, but are a part of the work in this course.

Principles of Forestry. Assistant Professors **Fisher** and **Jack**. (Half-course, first half-year.)

The purpose of this course is to furnish an understanding of the main principles of forestry, both in their relation to the community as a whole, and to the present conduct and future development of the lumber business. The general outline of the course is a summary of the economic and technical elements of forestry. The following topics indicate the ground covered: — the chief species of American trees and their identification; the biological and other natural laws controlling the life of the forest and its influence on its surroundings; and the principles underlying the practice of forestry as an art and a business; the timber supplies of the United States; — amount, consumption and growth; relative possibilities and obligations of public and private ownership of forest lands; discussion of concrete examples of applied forestry in typical lumber regions.

Although the survey of so large a field will necessarily be general, certain questions of special interest or direct use to men having to do with timberland ownership will be fully developed. What are the most practicable methods of reproducing forests, and to what extent can they be profitably applied by a business concern ? What, as a matter of established fact, is the effect of forests upon the distribution of surface and ground water, and hence upon stream flow ? How does fire affect present and future conditions in the forest, and what are the most effective means of protection against it ? What is the nature and comparative soundness of the chief methods of valuing timber and forest growth ? What are the actual and possible financial returns from forest property ?

The growing of timber as an industry can be established only under favorable economic and business conditions. It is equally certain that the logging and manufacture of timber by lumber concerns cannot endure without the ultimate adoption of more scientific methods of production and utilization. The future of the lumber business and the development of forestry are thus destined to be more and more closely identified.

The field work of the course is conducted both at the Arnold Arboretum and in such tracts of woodland under management as are accessible to Cambridge.

General Lumbering. Assistant Professor Gries. (Half-course, first half-year.)

This course follows the course in General Lumbering given in the first year. In preparation, the student spends the summer following the first year's work in the employ of some lumber company. The course is in part a study in the marketing of a single product — lumber.

The work of the course begins with a brief study of the physical properties and uses of wood, and is followed by a discussion of the requirements of consumers or users of wood, such as the building trades, railroads, and certain selected wood-using industries, and of the buying methods of different wood-using concerns.

In the marketing of a product it is of advantage to know not only the physical properties and uses of the product, and the requirements of the consumer, but also the methods of distributors. The chief points to be considered in connection with the distribution of lumber are: — the retail lumber trade: buying, stock handling, selling, and accounting methods, credit policies, and the development of the retail line yard; the wholesale lumber trade: the different types of wholesalers, and the various methods of buying, stock handling, and selling; manufacturing: selling policies, organizations, and the effects of changes in consumers' requirements upon logging and milling.

The concluding lectures are devoted to specific problems of management, and policies considered or adopted in their solution.

Besides the regular class work, students are assigned special problems to be investigated and worked out on the subject of uses of wood, marketing and manufacture.

Lumber Problems. Assistant Professor GRIES. (Full course, second half-year.)

In this course practical problems connected with the lumber business are assigned to each student for original investigation under the supervision of the instructor in charge. The problems may involve work in the operations of a number of different companies, or they may require that the student's entire time be devoted to one concern. The general character of the problems to be investigated depends upon his previous training and plans for the future.

The problems, as a rule, are such that the student cannot avail himself of a fixed or prescribed method of procedure, but must rely upon his power of analysis and resourcefulness, and upon his knowledge of the lumber business and general business practice. At least one problem assigned to each student requires a careful collection and use of statistics.

Students are freely encouraged and assisted in their research by lumbermen and operators of wood-using plants, and with this help they are able to make investigations of practical value. Frequent conferences with the instructor give an opportunity for reporting results and receiving further instruction; and later, at special sessions, the final report of each student is brought before the class for general discussion.

Registration

All first-year students of lumbering, except those whose previous experience is accepted by the Dean as a satisfactory equivalent, are expected to meet the instructors for the logging and sawmill work on the 25th of August, one month in advance of the opening of college, at a place to be arranged by corresponding with the Secretary of the School. It is essential that intending students should notify the Secretary as long beforehand as possible in order that the necessary arrangements for board, lodging, and the conduct of the field work may be made.

Living expenses will be extremely reasonable, and the location is such that for men coming ultimately to Cambridge, the entire cost of the trip should not exceed $50. Registration for the subsequent lecture and class-room work takes place at Cambridge on September 24, 1917. For further information concerning the field work, and the courses offered, address the Secretary, 17 University Hall, Cambridge, Mass.

14

OFFICIAL REGISTER OF HARVARD UNIVERSITY

VOLUME XIV MARCH 29, 1917 NO. 13

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

Preliminary Edition

PROPERTY OF DIVISION OF
FORESTRY
COLLEGE OF AGRICULTURE
UNIVERSITY OF CALIFORNIA

Cambridge
Published by the University
1917-18

PUBLICATIONS OF THE HARVARD GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

HARVARD BUSINESS STUDIES

Volume 1. Scientific Management. A Collection of the More Significant Articles Describing the Taylor System of Management. Edited by Clarence Bertrand Thompson, LL.B., A.M. Price $4.00.

Volume 2. An Approach to Business Problems. By A. W. Shaw, A.M. $2.00 net.

Volume 3. Business Statistics. Edited by M. T. Copeland, Ph.D. *In press.*

Volume 4. Lectures on Printing. D. Berkeley Updike, A.M., A. W. Elson and others. *In press.*

STUDENT REPORTS ON BUSINESS PROBLEMS

Report No. 1. Comparative Basic Costs of Manufacture by Hand, Linotype, and Monotype, of 8-, 10-, and 12-Point Non-technical Text Matter, Set Both Leaded and Solid. By Henry Huntly Taylor, M.B.A. (Awarded the May Prize in 1914 as the best graduation thesis in the Harvard Graduate School of Business Administration.) Price 50 cents.

BUREAU OF BUSINESS RESEARCH

Bulletin No. 1.	**Object and History of the Bureau, with Some Preliminary Figures on the Retailing of Shoes**	
Bulletin No. 2.	**Harvard System of Accounts for Shoe Retailers**	**Price 50 cents**
Bulletin No. 3.	**Harvard System of Accounts for Retail Grocers**	**Price 50 cents**
Bulletin No. 4.	**Depreciation in the Retail Shoe Business**	**Price 50 cents**
Bulletin No. 5.	**Expenses in Operating Retail Grocery Stores.**	**Price 50 cents**
Bulletin No. 6.	**Harvard System of Accounts for Shoe Wholesalers**	**Price 50 cents**
Bulletin No. 7.	**Harvard System of Stock-keeping for Shoe Retailers**	**Price 50 cents**
Bulletin No. 8.	**System of Operating Accounts for Wholesale Grocers**	**Price 50 cents**

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

of

HARVARD UNIVERSITY

PROPERTY OF DIVISION OF
FORESTRY
COLLEGE OF AGRICULTURE
UNIVERSITY OF CALIFORNIA

Preliminary Edition

Cambridge
Published by the University
1917

Contents

PAGE

CALENDAR 5

FACULTY AND SPECIAL LECTURERS 6

GENERAL STATEMENT 13

REQUIREMENTS FOR ADMISSION 15

REQUIREMENTS FOR DEGREES 17

PROGRAM OF INSTRUCTION 18

TABULAR VIEW OF CLASS EXERCISES 21

DESCRIPTION OF COURSES 22

- Accounting 22
  - Accounting Principles 22
  - Accounting Practice 23
  - Industrial Accounting 24
  - Industrial Accounting (advanced course) 24
  - Accounting Problems 25
- Law 25
  - Commercial Contracts 27
  - Law relating to Business Associations 27
  - Law relating to Banking Operations 28
- Marketing 29
  - Marketing 30
  - Advertising 32
  - Marketing Perishable Food Products 33
  - Retail and Wholesale Store Management 34
  - Purchasing 35
- Industrial Management 35
  - Factory Management 36
  - Factory Practice 37
  - Factory Management Problems 38
  - The Taylor System of Management 39
- General Business Problems 40
  - Business Statistics 41
  - Business Policy 42
- Foreign Trade 43
  - Foreign Trade Methods 45
  - European Trade 45
  - Latin-American Trade Problems 47
- Banking and Finance 48
  - Banking (first-year course) 49
  - Banking (second-year course) 49
  - Investments 50
  - The Financial Management of Industrial Corporations 50
  - The Financial Management of Railroad Companies 51

PAGE

DESCRIPTION OF COURSES

Transportation 52
  Railroad Organization 53
  Railroad Accounting 54
  Railroad Operation 55
  Railroad Operating Problems 56
  Railroad Rate-Making 57
  Water Transportation 58
Insurance 59
  Fire Insurance Principles 59
  Fire Insurance Engineering 60
  Life Insurance Principles 61
  Life Insurance Agency Methods 61
  Actuarial Practice 62
Printing and Publishing 63
  Printing and Publishing (first-year course) 64
  Printing and Publishing (second-year course) 65
Courses Training for Secretaryships of Chambers of Commerce 67
  Chamber of Commerce Work and Methods 67
  Chamber of Commerce Problems 68
Local Public Utilities 69
  Public Utilities Operation (first-year course) 70
  Public Utilities Operation (second-year course) 71
  [The Financial Management of Local Public Service Corporations] 71
Lumbering 72
  Principles of Forestry 74
  General Lumbering (first-year course) 75
  General Lumbering (second-year course) 76
  Lumber Problems (second-year course) 77
BUREAU OF BUSINESS RESEARCH 78
LIBRARY FACILITIES 79
POSITIONS 81
BOND REQUIREMENTS 83
FEES 83
PRIZES 86
STUDENT AIDS 86
STUDENTS' EXPENSES 89
STUDENTS, 1916–17 91
GRADUATES IN 1916 102
STATISTICS 104

1917

JULY

Su	Mo	Tu	W	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..
..	..	..	..	..	..	..

AUGUST

..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	..
..	..	..	..	..	..	..

SEPTEMBER

..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	..	..	..	..	..	..

OCTOBER

..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	..	..	..
..	..	..	..	..	..	..

NOVEMBER

..	..	..	..	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	..
..	..	..	..	..	..	..

DECEMBER

..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	..	..	..	..	..

1918

JANUARY

Su	Mo	Tu	W	Th	Fr	Sa
..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	..	..
..	..	..	..	..	..	..

FEBRUARY

..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	..	..
..	..	..	..	..	..	..

MARCH

..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	..	..	..	..	..	..

APRIL

..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	..	..	..	..
..	..	..	..	..	..	..

MAY

..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	..
..	..	..	..	..	..	..

JUNE

..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	..	..	..	..	..	..

JULY

Su	Mo	Tu	W	Th	Fr	Sa
..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	..	..	..
..	..	..	..	..	..	..

AUGUST

..	..	..	..	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
..	..	..	..	..	..	..

SEPTEMBER

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	..	..	..	..	..
..	..	..	..	..	..	..

OCTOBER

..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	..	..
..	..	..	..	..	..	..

NOVEMBER

..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
..	..	..	..	..	..	..

DECEMBER

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..
..	..	..	..	..	..	..

Calendar

1917

Sept. 24,	*Mon.*	ACADEMIC YEAR BEGINS in all departments of the University. Payment of the first instalment of the tuition fee is required on or before this date.
Oct. 12,	*Fri.*	Columbus Day: a holiday.
Nov. 23,	*Fri.*	Second instalment of the tuition fee is due on or before this date.
Nov. 29,	*Thurs.*	Thanksgiving Day: a holiday.
Dec. 1,	*Sat.*	Last day for filing subject of graduation thesis.

Recess from Dec. 23, 1917, to Jan. 2, 1918, inclusive.

1918

Jan. 28,	*Mon.*	SECOND HALF-YEAR BEGINS.
Feb. 11,	*Mon.*	The first term-bill is due on this date. Third instalment of the tuition fee is due on or before this date.
Feb. 22,	*Fri.*	Washington's Birthday: a holiday.
Mar. 30,	*Sat.*	Last day for re-engaging College Rooms for 1918–19.
April 10,	*Wed.*	Last day for receiving graduation theses.

Recess from April 14 to April 20, Inclusive.

April 22,	*Mon.*	Fourth instalment of the tuition fee is due on or before this date.
April 25,	*Thurs.*	Last day for receiving essays for the Hodgson Prize.
May 2,	*Thurs.*	Last day for receiving applications for College Rooms for 1918–19.
May 30,	*Thurs.*	Memorial Day: a holiday.
June 1,	*Sat.*	End of final examinations.
June 19,	*Wed.*	All dues of candidates for degrees must be paid on or before this date.
June 20,	*Thurs.*	COMMENCEMENT.

Summer Vacation, from Commencement Day to September 22, inclusive.

July 20,	*Sat.*	Payment of the second term-bill is due on or before this date.
Sept. 23,	*Mon.*	ACADEMIC YEAR BEGINS in all departments of the University. Payment of the first instalment of the tuition fee is required on or before this date.

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

Faculty

ABBOTT LAWRENCE LOWELL, A.B., LL.B., LL.D., Ph.D.
PRESIDENT.

EDWIN FRANCIS GAY, Ph.D.
DEAN, and *Professor of Economics.*

WILLIAM BLISS MEDLICOTT, S.B.
Lecturer on Fire Insurance.

HERBERT BEEMAN DOW, A.M.
Lecturer on Life Insurance.

JOHN FARWELL MOORS, A.M., LL.D.
Lecturer on Investment.
This Lectureship is maintained from the income of the Edmund Cogswell Converse Fund.

EDGAR JUDSON RICH, A.M., LL.B.
Lecturer on the Theory and Practice of Rate-Making.
This Lectureship is maintained from the income of the James J. Hill Fund.

WILLIAM HENRY BLOOD, Jr.
Lecturer on Public Utilities.

WILLIAM MORSE COLE, A.M.
Professor of Accounting.

OLIVER MITCHELL WENTWORTH SPRAGUE, Ph.D.
Edmund Cogswell Converse Professor of Banking and Finance.

WILLIAM JAMES CUNNINGHAM
James J. Hill Professor of Transportation.

ARCH WILKINSON SHAW, A.M.
Lecturer on Business Policy.
This Lectureship is maintained from the income of the Isidor Straus Fund.

RICHARD THORNTON FISHER, A.B. M.F.
Assistant Professor of Forestry, and *Director of the Harvard Forest.*

HARRY CLINTON MCCARTY, A.B.
Lecturer on Marketing.

James Willing, C.A.
Lecturer on Accounting.

Lincoln Frederick Schaub, A.M., LL.B.
Professor of Commercial Law. (On leave of absence during academic year 1917–18.)

Paul Terry Cherington, S.B., A.M.
Assistant Professor of Marketing.

Frederic Gallup Coburn, S.M.
Lecturer on Factory Management.

Charles Chester Lane, A.M.
Lecturer on Printing and Publishing.

John Matthew Gries, A.M.
Assistant Professor of Lumbering.

Melvin Thomas Copeland, Ph.D.
Assistant Professor of Marketing, and *Director of the Bureau of Business Research.*

Julius Klein, Ph.D.
Instructor in Latin-American History and Economics.

Walle Merritt, A.B., J.D.
Lecturer on Commercial Law.

Lester R. Ford, Ph.D.
Instructor in Actuarial Mathematics.

Henry Hallowell Farquhar, A.B., M.B.A.
Instructor in Factory Management.

Walter Moreland Stone, A.B.
Superintendent of the Special Library of the Graduate School of Business Administration, and *Assistant in Printing.*

Howard Belding Gill, A.B., M.B.A.
Assistant in Marketing.

Don Lorenzo Stevens, S.B., M.B.A.
Assistant in Public Utilities Operation.

Lecturers in Business Policy

Richard Burrage Carter, A.M., *President*, Carter's Ink Co., Cambridge.

Howard Coonley, A.B., *President*, Walworth Manufacturing Co., South Boston.

WALTER HORACE COTTINGHAM, *President*, The Sherwin-Williams Co., Cleveland.

HENRY STURGIS DENNISON, A.B., *Treasurer*, Dennison Manufacturing Co., South Framingham.

PAUL EDWARD FITZPATRICK, A.B., *Director*, Brown, Durrell & Co., Boston.

CHARLES HENRY JONES, A.M., *President*, Commonwealth Shoe and Leather Co., Boston.

HENRY PLIMPTON KENDALL, A.B., *of* Plimpton Press, Norwood.

JOHN SILSBEE LAWRENCE, A.B., *Member of firm*, Lawrence & Co., Boston.

HERBERT WARREN MASON, A.B., *Member of firm*, S. D. Warren & Co., Boston.

ELWYN GREELEY PRESTON, *Treasurer*, S. S. Pierce Co., Boston.

WILLIAM FRANCIS SEVERN, *President*, The A. W. Burritt Co., Bridgeport, Conn.

JOHN ROY SIMPSON, A.B., *Vice-President and Merchandise Manager*, Wm. Filene's Sons Co., Boston.

THOMAS WILLIAMS SLOCUM, A.B., *Member of firm*, Minot, Hooper & Co., New York.

Lecturers in Factory Management

LEON P. ALFORD, *Editor*, American Machinist, New York.

JOHN BERTRAM ANDREWS, Ph.D., *Secretary*, American Association for Labor Legislation, New York.

CHARLES DAY, S.B., M.E., *Expert in Industrial Organization*, Philadelphia.

HENRY STURGIS DENNISON, A.B., *Treasurer*, Dennison Manufacturing Co., South Framingham.

HENRY LAURENCE GANTT, *Expert in Industrial Organization*, New York.

CHARLES BUXTON GOING, Ph.B., S.M., *formerly Editor*, Engineering Magazine, New York.

HORACE KING HATHAWAY, *Vice-President and Manager*, Tabor Manufacturing Co., Philadelphia.

GIFFORD LE CLEAR, A.M., *Member of firm*, Densmore & Le Clear, Boston.

EVERETT MORSS, S.B., *President*, Simplex Electrical Co., Boston.

JOHN F. TOBIN, *President*, Boot and Shoe Workers Union, Boston.

Lecturers in Factory Management Problems

Henry Laurence Gantt, *Expert in Industrial Organization*, New York.

Horace King Hathaway, *Vice-President and Manager*, Tabor Manufacturing Co., Philadelphia.

Sanford E. Thompson, S.B., *Consulting Engineer*, Newton Highlands.

Reginald A. Wentworth, S.B., *Superintendent*, Saco-Lowell Shops, Lowell.

Lecturers in Railroad Rate-Making

Henry Clay Barlow, *Traffic Commissioner*, The Chicago Association of Commerce, Chicago.

William H. Chandler, *Transportation Manager*, Boston Chamber of Commerce, Boston.

George Henry Eaton, *Assistant Freight Traffic Manager*, Boston and Maine Railroad, Boston.

Halford Erickson, *formerly Chairman*, Wisconsin Public Service Commission, Madison.

George Lewis Graham, *General Freight Agent*, American Woolen Co., Boston.

William T. LaMoure, *General Freight Agent*, Boston and Maine Railroad, Boston.

Dick T. Lawrence, *Member*, Official Classification Committee, New York.

William P. Libby, *Traffic Manager*, Plymouth Cordage Co., Plymouth.

Lecturers in Fire Insurance Engineering

F. Elliot Cabot, A.B., *Secretary*, Boston Board of Fire Underwriters.

William Wyman Crosby, S.B., *Architect Engineer*, Boston.

Gorham Dana, S.B., *Manager*, Underwriters Bureau of New England.

Milton F. Jones, S.B., *Engineer*, New England Bureau of United Inspection.

Isaac Osgood, *Engineer*, Boston Board of Fire Underwriters.

J. Albert Robinson, *of* Underwriters Bureau of New England.

Thomas E. Sears, S.B., *of* Gilmour & Coolidge, Boston; *formerly Engineer*, Mill Mutual Fire Insurance Co.

Ralph Sweetland, S.B., *Superintendent, Improved Risks Department*, New England Insurance Exchange.

Henry V. Thayer, *Superintendent of Inspections*, Boston Board of Fire Underwriters.

Franklin H. Wentworth, *Secretary*, National Fire Protection Association.

Lecturers in Printing and Publishing

Herbert Lynn Baker, *General Sales Manager*, C. B. Cottrell & Sons Co., New York.

Arthur Everett Barter, *General Superintendent*, Plimpton Press, Norwood.

Walter J. Berwick, *Treasurer*, Berwick & Smith Co., Norwood, Mass.

Luther Phillips Cudworth, *Production Manager*, Christian Science Monitor, Boston.

Alfred W. Elson, *of* A. W. Elson & Co., Boston.

Albert W. Finlay, *President and Manager*, George H. Ellis Co., Boston.

Frank T. Hull, *of* The University Press, Cambridge.

Arthur Dehon Little, *Official Chemist*, The American Paper and Pulp Association, Boston.

John Horace McFarland, *Secretary and Treasurer*, J. Horace McFarland Co., Harrisburg.

Edgar E. Nelson, *Secretary*, Boston Typothetae Board of Trade.

John Clyde Oswald, *President*, Oswald Publishing Co., New York.

Charles Schweinler, *of* The Charles Schweinler Press, New York.

Donald Scott, A.B., New York.

William A. Spurrier, *Manager*, Southgate Press, Boston.

Daniel Berkeley Updike, A.M., *of* The Merrymount Press, Boston.

Lecturers in Public Utilities Operation

Edward Webster Bemis, Ph.D., *Special Investigator of Public Utilities*, Chicago.

Henry Goddard Bradlee, S.B., *President*, Stone & Webster Management Association, Inc., Boston.

Francis Brown, A.B., S.B., *Purchasing Agent*, Chase-Shawmut Co., Newburyport, Mass.

Matthew Chauncey Brush, S.B., *President*, Boston Elevated Railway Co., Boston.

Everett Watson Burdett, LL.B., *of* Burdett, Wardwell & Ives, *Attorneys*, Boston.

George E. Claflin, S.B. *Vice-President*, Electric Bond & Share Co., New York.

Benjamin Franklin Cleaves, *Chairman*, Public Service Commission, State of Maine, Augusta, Maine.

Harry Ellsworth Clifford, S.B., Harvard University.

Davis Meade DeBard, M.E., *Contract Agent*, Edison Electric Illuminating Co., Brockton.

William Andrew Durgin, S.B., *Lighting Consultant*, Commonwealth Edison Co., Chicago.

Leonard L. Elden, *Electrical Engineer*, Edison Electric Illuminating Co., Boston.

Weldon Winans Freeman, *President*, Union Gas & Electric Co., Cincinnati.

Charles Edward Fuller, S.B., Massachusetts Institute of Technology, Cambridge.

Louis David Gibbs, A.B., *Superintendent of Advertising*, Edison Electric Illuminating Co., Boston.

John Foster Gilchrist, *Vice-President*, Commonwealth Edison Co., Chicago.

Walter Goodenough, A.B., *Chief Engineer*, Stone & Webster Engineering Corporation, Boston.

William Henry Hodge, *of* H. M. Byllesby & Co., Chicago.

John A. Hunnewell, A.B., *Manager*, The Lowell Electric Light Corporation, Lowell.

Charles Welsh Hunter, M.E., *Gas Engineer*, Stone & Webster Engineering Corporation, Boston.

Edmond Earle Lincoln, A.M., Harvard University.

Joseph B. McCall, *President*, Philadelphia Electric Co., Philadelphia.

James D. Mortimer, *President*, The North American Co., New York.

Luther Roberts Nash, S.M., *Local Public Utilities Expert*, Stone & Webster Management Association, Inc., Boston.

John Elliott Oldham, A.B., *Member of firm*, Merrill, Oldham & Co., Investment Bankers, Boston.

Francis Brinley Hebard Paine, *Member of firm*, Paine, McClellan & Campion, Engineers, New York.

Russell Robb, S.B., *Member of firm*, Stone & Webster, Boston.

Howard T. Sands, *of* Charles H. Tenney & Co., Boston.

Alonzo Rogers Weed, LL.B., *Chairman*, Board of Gas and Electric Light Commissioners, Commonwealth of Massachusetts, Boston.

Walter Farrington Wells, E.E., *Vice-President and General Manager*, Edison Electric Illuminating Co., Brooklyn.

Norman Tryon Wilcox, *Sales Manager*, Mississippi River Power Co., Keokuk, Iowa.

PROPERTY OF DIVISION OF
FORESTRY
COLLEGE OF AGRICULTURE
UNIVERSITY OF CALIFORNIA

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

1917–18

General Statement

THE Graduate School of Business Administration was established in March, 1908, by votes of the President and Fellows and of the Board of Overseers of Harvard College. It was established as a separate Faculty by vote of the Governing Boards on June 19, 1913.

The aim of the School is to furnish instruction and opportunity for investigation in the principles of business organization and administration and to supplement this with such elective courses as will enable students to receive special preparation for particular lines of business activity. The work in all courses is in a large measure conducted with concrete problems as a basis.

The School is strictly a graduate department of the University, and is therefore open only to students whose education and maturity fit them to undertake serious professional study. The requirement for admission as a regular student and candidate for the degree of Master in Business Administration is the possession of a bachelor's degree from an approved college or scientific school. Opportunities for special study are, however, open to students not candidates for a degree.

Academic Year and Registration

The academic year 1917–18 will begin on Monday, September 24, 1917, and work in the School will close with the final examinations, ending on June 1, 1918. There will be a recess from December 23, 1917, to January 2, 1918, inclusive; and from April 14 to April 20, inclusive.

The regular work in classes will begin on Tuesday, September 25, 1917.

Every student in the School and every applicant for admission is expected to be present in Cambridge at the beginning of each year of his membership in the School, and to register on Monday, the first day of the academic year, by filling a registration blank and filing it at the office of the School, or at such other place as may be designated by notice posted in University Hall. A student who enters on his studies after the beginning of the academic year must register at once at the office of the School.

On registering, a student receives a certificate of registration from the officer in charge; this certificate he must present to the Bursar, when he files his bond or gives other satisfactory security for the payment of his dues for the year; and he will obtain from the Bursar authorization to attend instruction and to use the College Library. In case the registration is afterwards not accepted, it will be cancelled, and the student will not be liable for tuition fees; or he may be transferred to another department of the University.

A student is counted as a member of the School only from the date of his registration, and during the period when he is actually enrolled as a student in the School.

A student who withdraws from the School in the course of an academic year is required to give immediate written notice at the office of the School. Only when such notice is given may an application for deduction from the full year's fees be considered.

At registration, or within two days thereafter, every student of the School is required to submit to the Dean his list of elective studies for approval and then to file this list, countersigned by the Dean, at the office of the School. Any subsequent change in this list of studies must be similarly approved and filed.

Requirements for Admission

GRADUATES of approved colleges or scientific schools are admitted without examination as regular students and candidates for the degree of Master in Business Administration.

Undergraduates of Harvard College who have completed the requirements for the degree of Bachelor of Arts or of Science, but have not received the degree, are admitted to the Graduate School of Business Administration. Those who lack not more than a single course of the requirements are admitted to the School at the beginning of the academic year if in the judgment of the Dean they are likely to prosecute satisfactorily the work of the School. Such men constitute the group of unclassified students and their entire work must be carried on under the supervision of the School.

Ordinarily students are not allowed to enter the School at the beginning of the second half-year.

College graduates may enter any course as special students but their admission is in each case subject to the approval of the Dean. In addition men who have reached the age of twenty-one and have had at least three years of consecutive business experience may be admitted as special students upon obtaining the permission of the Dean. Such students are not candidates for a degree ; but they may be given a certificate on completing satisfactorily the work of the course or courses to which they are admitted. As a rule such students will be permitted to take, whether in the same year or in different years, not more than a total of two courses in the School.

Recommendations as to Preparatory Studies

Though a bachelor's degree will ordinarily admit the student to regular standing, it is recommended that he pursue during the latter part of his college career certain studies which will be useful to him in preparing for the more highly specialized

work of the Graduate School of Business Administration. Such studies are usually offered in any good college or scientific school. If the student's preparation is found inadequate, he may complete it after entrance; and it is advisable for him to consult with the Dean as soon as possible in regard to the manner in which such deficiencies are to be made good.

Among the courses offered by the Department of Economics in Harvard College those on the industrial and financial phenomena of modern times are of service to students who purpose to enter the School. Such are the courses on Principles of Economics (*A*), Money, Banking and Commercial Crises (3), Economics of Transportation (4*a*), Trade-Unionism and Allied Problems (6*a*), Economics of Corporations (4*b*), Public Finance, (5), the Economic History of the United States (2*b*), European Industry and Commerce in the Nineteenth Century (2*a*), Statistics (1*b*), and Physiography, elementary course (Geography 1).

Some knowledge of mechanical drawing is highly useful in almost all branches of business. A command of good English and a reading knowledge of at least one modern language, either German, French, or Spanish, are desirable. The increased interest in our business relations with South America indicates the desirability of a thorough undergraduate training in Spanish for those who think it at all possible that they may enter the Business School.

The training in exact observation and the specific knowledge acquired in mathematics and in such scientific studies as physics and chemistry are of no less importance in many lines of business administration. An administrative officer engaged in the business of manufacturing, transportation, or insurance, can effectively grasp many essential parts of his business only through a knowledge of the mechanical, chemical, or physical phenomena and laws involved. A thorough knowledge of mathematics, including calculus, is of profit to any serious student, and is, indeed, essential in certain professions, such as that of the actuary.

But while it is strongly recommended that preparation for the work of the School and for the later business career should include the subjects here indicated, attention is called to the fact that one of the chief objects of requiring a bachelor's degree for admission to the Graduate School of Business Administration is that the strictly professional work of the School may rest upon a foundation of liberal studies. A due proportion of the preparatory college course should, therefore, be given to studies having a general value for education and culture.

Requirements for Degrees

Master in Business Administration

THE degree of Master in Business Administration is granted on the satisfactory completion of an approved program of study, normally requiring two years of residence. A longer period of residence and study may be necessary for students whose preparation has been inadequate.

A complete year's work ordinarily consists of four full courses of advanced grade, pursued throughout the academic year, or of equivalent work, whether done in connection with any course or courses of instruction or carried on outside of the courses, provided that the weight it is designed to have in the year's program is approved by the Faculty.

Each second-year student is required to submit a satisfactory thesis dealing with some concrete problem in the business which he plans to enter and embodying the results and conclusions derived from his original investigation of actual business conditions. A statement giving the subject of his thesis, and an approval thereof in writing by some member of the staff of instructors in the School, must be filed with the Dean before December 1, and the completed thesis must be presented to the Dean before April 10.

work of the Graduate School of Business Administration. Such studies are usually offered in any good college or scientific school. If the student's preparation is found inadequate, he may complete it after entrance; and it is advisable for him to consult with the Dean as soon as possible in regard to the manner in which such deficiencies are to be made good.

Among the courses offered by the Department of Economics in Harvard College those on the industrial and financial phenomena of modern times are of service to students who purpose to enter the School. Such are the courses on Principles of Economics (*A*), Money, Banking and Commercial Crises (3), Economics of Transportation (4*a*), Trade-Unionism and Allied Problems (6*a*), Economics of Corporations (4*b*), Public Finance, (5), the Economic History of the United States (2*b*), European Industry and Commerce in the Nineteenth Century (2*a*), Statistics (1*b*), and Physiography, elementary course (Geography 1).

Some knowledge of mechanical drawing is highly useful in almost all branches of business. A command of good English and a reading knowledge of at least one modern language, either German, French, or Spanish, are desirable. The increased interest in our business relations with South America indicates the desirability of a thorough undergraduate training in Spanish for those who think it at all possible that they may enter the Business School.

The training in exact observation and the specific knowledge acquired in mathematics and in such scientific studies as physics and chemistry are of no less importance in many lines of business administration. An administrative officer engaged in the business of manufacturing, transportation, or insurance, can effectively grasp many essential parts of his business only through a knowledge of the mechanical, chemical, or physical phenomena and laws involved. A thorough knowledge of mathematics, including calculus, is of profit to any serious student, and is, indeed, essential in certain professions, such as that of the actuary.

But while it is strongly recommended that preparation for the work of the School and for the later business career should include the subjects here indicated, attention is called to the fact that one of the chief objects of requiring a bachelor's degree for admission to the Graduate School of Business Administration is that the strictly professional work of the School may rest upon a foundation of liberal studies. A due proportion of the preparatory college course should, therefore, be given to studies having a general value for education and culture.

Requirements for Degrees

Master in Business Administration

THE degree of Master in Business Administration is granted on the satisfactory completion of an approved program of study, normally requiring two years of residence. A longer period of residence and study may be necessary for students whose preparation has been inadequate.

A complete year's work ordinarily consists of four full courses of advanced grade, pursued throughout the academic year, or of equivalent work, whether done in connection with any course or courses of instruction or carried on outside of the courses, provided that the weight it is designed to have in the year's program is approved by the Faculty.

Each second-year student is required to submit a satisfactory thesis dealing with some concrete problem in the business which he plans to enter and embodying the results and conclusions derived from his original investigation of actual business conditions. A statement giving the subject of his thesis, and an approval thereof in writing by some member of the staff of instructors in the School, must be filed with the Dean before December 1, and the completed thesis must be presented to the Dean before April 10.

work of the Graduate School of Business Administration. Such studies are usually offered in any good college or scientific school. If the student's preparation is found inadequate, he may complete it after entrance; and it is advisable for him to consult with the Dean as soon as possible in regard to the manner in which such deficiencies are to be made good.

Among the courses offered by the Department of Economics in Harvard College those on the industrial and financial phenomena of modern times are of service to students who purpose to enter the School. Such are the courses on Principles of Economics (*A*), Money, Banking and Commercial Crises (3), Economics of Transportation (4*a*), Trade-Unionism and Allied Problems (6*a*), Economics of Corporations (4*b*), Public Finance, (5), the Economic History of the United States (2*b*), European Industry and Commerce in the Nineteenth Century (2*a*), Statistics (1*b*), and Physiography, elementary course (Geography 1).

Some knowledge of mechanical drawing is highly useful in almost all branches of business. A command of good English and a reading knowledge of at least one modern language, either German, French, or Spanish, are desirable. The increased interest in our business relations with South America indicates the desirability of a thorough undergraduate training in Spanish for those who think it at all possible that they may enter the Business School.

The training in exact observation and the specific knowledge acquired in mathematics and in such scientific studies as physics and chemistry are of no less importance in many lines of business administration. An administrative officer engaged in the business of manufacturing, transportation, or insurance, can effectively grasp many essential parts of his business only through a knowledge of the mechanical, chemical, or physical phenomena and laws involved. A thorough knowledge of mathematics, including calculus, is of profit to any serious student, and is, indeed, essential in certain professions, such as that of the actuary.

Accounting Principles.
Commercial Contracts.
Marketing.

Ability to write English clearly and concisely is of such importance to a business man that provision is made for instruction to correct deficiencies in the English training of students entering the School. All papers and reports written by students in Marketing are read and criticized constructively not only by the instructor in the course but also by an instructor in English. Satisfactory completion of the course is conditional upon attaining the required proficiency in English. In other courses defectively written reports are also referred to the English instructor. Hereafter no student will be recommended for the degree of Master in Business Administration until he has satisfied the School's requirements in the writing of English.

The classification of courses in groups is not intended to limit the lines of study within which a student preparing for a special field should work. Experience has shown that the student specializing in one field has an adequate preparation for the work in that field only when he has studied other subjects which on a superficial view seem unrelated but are in reality closely linked to his specialty.

In the first year the courses ordinarily selected by students and recommended by the Faculty consist of the three required courses above mentioned and an introductory course in the group in which the student desires to specialize during his second year. Since the courses offered in the School are all of advanced grade, and since uniformly serious work is expected of students, a student is not permitted usually to take more than five full courses each year. Students whose work is at any time unsatisfactory will be notified and, if no improvement is evident thereafter, will be requested to leave the School.

In order to secure as much time as possible for the actual work in the School, classes are continued throughout the

Students who complete the program of study with distinguished excellence will receive the degree of Master in Business Administration with Distinction.

Doctor of Philosophy in Business Economics

A new course of study leading to the degree of Doctor of Philosophy in Business Economics is open to men desiring to undertake research in business subjects. It will serve primarily those who intend to become teachers in this field. The degree will be administered by the Graduate School of Arts and Sciences acting through the Division of History, Government, and Economics, and in coöperation with the teaching staff of the Graduate School of Business Administration.

Additional information can be obtained by applying to the Secretary of the Graduate School of Arts and Sciences, 24 University Hall, or, if desired, by applying to the Secretary of the Graduate School of Business Administration, 17 University Hall, Cambridge.

Program of Instruction

SINCE the aim of the School is to give to each individual student a practical and specialized professional training suitable to the particular business which he plans to enter, freedom of election is provided for a part of the courses of the first year and for all the courses of the second year. The courses selected by the student should be chosen in accordance with a definite plan. Each student before enrolling in an elective course must submit to the Dean for approval the list of studies he desires to pursue.

All students regularly admitted as candidates for the degree are ordinarily required in the first year of the two years' program of study to take the following three courses: —

Accounting Principles.
Commercial Contracts.
Marketing.

Ability to write English clearly and concisely is of such importance to a business man that provision is made for instruction to correct deficiencies in the English training of students entering the School. All papers and reports written by students in Marketing are read and criticized constructively not only by the instructor in the course but also by an instructor in English. Satisfactory completion of the course is conditional upon attaining the required proficiency in English. In other courses defectively written reports are also referred to the English instructor. Hereafter no student will be recommended for the degree of Master in Business Administration until he has satisfied the School's requirements in the writing of English.

The classification of courses in groups is not intended to limit the lines of study within which a student preparing for a special field should work. Experience has shown that the student specializing in one field has an adequate preparation for the work in that field only when he has studied other subjects which on a superficial view seem unrelated but are in reality closely linked to his specialty.

In the first year the courses ordinarily selected by students and recommended by the Faculty consist of the three required courses above mentioned and an introductory course in the group in which the student desires to specialize during his second year. Since the courses offered in the School are all of advanced grade, and since uniformly serious work is expected of students, a student is not permitted usually to take more than five full courses each year. Students whose work is at any time unsatisfactory will be notified and, if no improvement is evident thereafter, will be requested to leave the School.

In order to secure as much time as possible for the actual work in the School, classes are continued throughout the year with an interruption of only three days at the usual mid-year examination period.

In the courses on Commercial Law the case-system is used. In the other courses, an analogous method, emphasizing class-room discussion in connection with lectures and frequent reports on assigned topics, — what may be called the "problem-method," — is employed as far as practicable. Although the material for these problems and reports is often drawn from the records and experience of large corporations, which have developed the most advanced methods and published the most comprehensive reports, the training acquired is equally serviceable for men who are to be employed by smaller concerns or who hope to establish themselves independently.

Visits of inspection are made under competent guidance to various commercial and manufacturing establishments in Boston and in the neighboring manufacturing centres of New England. Similar field work of a more specialized character forms a feature of the advanced work of the second year. Advisory committees of leading business men in a number of industries coöperate with the staff of the School in guiding the work, especially of second-year students.

None of the courses here offered can be counted towards the degree of A.B. or S.B.

Tabular View of Class Exercises *Monday, Wednesday, and Friday*

Hour	9	10	11	12	1.30	2.30	3.30	4.30–6
Course	**Marketing** **Business Policy**	**Accounting Principles** **Law relating to Banking Operations** *first half-year*	**Accounting Practice** *second half-year* **Industrial Accounting** *first half-year* **Banking** *2d-year course Mon. and Wed.* **Railroad Operating Problems** **Chamber of Commerce Work and Methods** *second half-year*	**Accounting Problems**	**Factory Management** *first half-year, 2–3.30* **Life Insurance Principles** *second half-year; Wed. and Fri.*	**Railroad Operation** **Fire Insurance Principles** *first half-year Friday only 2.30–4.30.* **Latin-American Trade Problems** *second half-year*	**Railroad Organization** *first half-year* **Railroad Accounting** *second half-year* **Life Insurance Agency Methods** *second half-year; Wed., Fri., 3.30–5*	**Fire Insurance Engineering** *second half-year Wed. and Fri.* **Foreign Trade Methods** *first half-year* **Public Utilities Operation** *1st-year course; second half-year 4.30–5.30.*

Tuesday, Thursday, and Saturday

Hour	9	10	11	12	1.30	2.30	3.30	4.30–6
Course	**Business Statistics** *first half-year* **European Trade** *first half-year* **General Lumbering** *1st-year course; second half-year* **Water Transportation** *second half-year* **General Lumbering** *2d-year course; first half-year*	**Commercial Contracts** **Financial Management of Industrial Corporations** *first half-year* **Financial Management of Railroad Companies** *second half-year*	**Banking** *first-year course* **Principles of Forestry** *first half-year*	**Law relating to Business Associations**	**Industrial Accountng (advanced)** *second half-year; Sat., 2–5*	**Investments** *second half-year; Tu. and Th.* **Railroad Rate-Making** *Tu. and Th.*		**Printing and Publishing** *1st-year course Tu. and Th.*

In the following courses the hours to be arranged: —

- Advertising *first half-year*
- Marketing Perishable Food Products *second half-year*
- Retail and Wholesale Store Management *first half-year*
- Purchasing *second half-year*
- **Factory Practice** *second half-year*
- **Factory Management Problems**
- **The Taylor System of Management**
- **Actuarial Practice**
- **Printing and Publishing** *second-year course*
- **Public Utilities Operation** *second-year course; first half-year*
- Lumber Problems
- Chamber of Commerce Problems
- [*Financial Management of Local Public Service Corporations *second half-year*]

*Omitted in 1917–18.

Description of Courses

Accounting

IN the last twenty years the business world has come to see new value and new uses in accounts; and accountants have realized the necessity of constructing accounts so that they shall tell the operating manager what he needs to know about his business. Indeed, it may now be said that no business is conducted successfully, or can be long so conducted, unless some one is constantly analyzing that business and presenting the result of that analysis in a clear statement. Such analysis and statement is the accountant's task; and it is a very different task from that of the bookkeeper. The person who is a mere bookkeeper records known facts; the accountant, by scientific analysis, learns the facts to be recorded, or directs the bookkeeper in recording the known facts in such fashion that the unknown facts may be learned'

For purposes of general training the introductory course Accounting Principles ordinarily will be sufficient, but students who desire further training should take in addition during their first year Accounting Practice. The two half-courses in Industrial Accounting are designed to meet the needs of students in a variety of specialized lines, particularly Manufacturing. For those planning to enter the profession of accountancy, Accounting Principles and Accounting Practice are required in the first year as preparation for the advanced work in Accounting Problems and Industrial Accounting in the second year. These courses are intended to cover the ground contemplated under the C. P. A. certificate.

Accounting Principles

Professor COLE. *Mon., Wed., Fri., at* 10.

The purpose of this course is to indicate the fundamental and universal principles that accountants must use in their work. These are important for the manager who wishes either to direct his bookkeepers or to profit fully by the work of his accountants. Since, however, anyone who does not fully understand bookkeeping terms and methods is in danger of misinterpreting accounting statements, because he does not appreciate the facts behind the figures, an examination of certain main types of bookkeeping, with abundant practice in their use, forms a part of the year's work. The rest of the work is devoted to the study not only of fundamental principles — such as the distinction between capital and revenue, the nature of maintenance and depreciation, the methods of sinking funds, the effect of interest on valuations, the basis of cost accounting, — but of the practical application of these principles to the enterprises in which they are most conspicuous, and of the accounting peculiarities of businesses of universal interest, such as banking, insurance, transportation, and investment.

The course is prescribed for all candidates for the degree of Master in Business Administration.

Accounting Practice

Professor Cole. Half-course (second half-year). *Mon., Wed., Fri., at* 11.

This course is intended to follow (or to parallel), in concrete and practical form, the work of the introductory course in the principles of accounting. Practical work in the making of entries for concrete transactions in books of account that are highly developed and therefore illustrate advanced bookkeeping practice serves to give the student facility in the handling of common accounts. A study is then undertaken of the accounting methods in use for varying financial relations and for varying types of enterprise. Many of these involve technical knowledge of business customs and laws which, since they are not of universal application in ordinary business, are not considered in Accounting Principles. Illustrations of these are partnership settlements, administration of estates, and bankruptcy proceedings. Other subjects, introduced in Accounting Principles, are further developed in this course, — corporation accounts, for instance. Students preparing for a career in accountancy are expected to take this course. It is open only to students who have taken or are taking Accounting Principles.

Industrial Accounting

Professor Cole. Half-course (first half-year). *Mon., Wed., Fri., at* 11.

Proper accounting for productive enterprises requires something more than the determination of costs. The accounts show criteria not only for judging the effectiveness of labor and of materials and for determining the amounts and causes of waste, but also for establishing certain standards of both accomplishment and cost. This course continues the study of cost accounting begun in Accounting Principles, and examines in fuller detail the common methods of ascertaining both prime costs and burden costs, and the common methods of distributing the latter over various products. It then passes to the choice of methods, and the application of the chosen methods, for particular types of industrial enterprise. It next studies for a few typical industries the accounting records necessary for adequate check on effectiveness of materials and of labor, and for the determination of standards. Attention is given also to the content and form of operating reports for the guidance of various responsible officials and superintendents.

The course is open only to students who have taken Accounting Principles.

Industrial Accounting (Advanced course)

Mr. Willing. Half-course (second half-year.) *Sat.*, 2–5 p.m.

Students who have passed the first course in Industrial Accounting are given opportunity to gain practical experience through constructive work in plants open to their personal observation. The class is divided into groups, and each group has a problem to work out — sometimes the problem itself is divided among members of the group. This affords practice in observation, in analysis, in originality, and in judgment. The result required is a practicable system of accounts and accounting methods, with provision for adequate operating reports and statistics.

Accounting Problems

Professor Cole. *Mon., Wed., Fri., at* 12.

Analytical power, breadth of view, initiative, and resourcefulness, with regard to accountancy, are cultivated in this course. The problems considered are chosen almost wholly from fields where no legal prescription or formal traditional program of procedure can direct the student in his work. He is forced to fall back on his knowledge of principles, his knowledge of business practice, his power of analysis, and his native judgment. The problems considered during any year are determined in part by the general needs of the students, and in part by the expected special lines which students are likely to follow after graduation. Auditing (with practical work in actual audits) and devising systems for actual installation form a large part of the year's work.

Law

IN affairs not connected with business the risks incident to ignorance of the law are ordinarily not particularly formidable. On the other hand, however, so many of the activities of everyday business have legal consequences, and so many important businesses are now subject to governmental regulation that it is desirable and even necessary that a business man have a working knowledge of those rules of law that have frequent and direct application to the conduct of business.

A thorough grounding in the fundamental principles of business law enables the young business man to escape, from the start, many of the pitfalls that exist even in the ordinary transactions of business. Furthermore, a study of this kind leaves him with such a strong impression of the complexities of the law that it does not require hard experience to teach him how desirable it is, in every business situation that is at all unfamiliar, to seek capable legal advice before, rather than after the event. It is also evident that some knowledge of the law puts him in a position, whenever it may be necessary, to work with lawyers intelligently.

Of equal importance is the fact that a proper training in the law cultivates certain qualities which are directly useful in solving problems of a purely business character. The ability to analyze, and to discriminate, and to state clearly and concisely the facts of a complicated business situation is needed by the business man as much as by the lawyer.

Certain other benefits of a more general nature may reasonably be expected to result from a study of business law. It is scarcely necessary to state that a young man who is enabled to see the large relations of his own special work has decided advantages over one whose business horizon does not extend beyond the limits of his immediate position. Quite apart from such considerations, it is obvious that his work will be more interesting to him if he is qualified to observe the interaction of law and business on each other, and to compare the requirements of the law with the other external standards by which conduct is regulated, such as general custom, sound business practice, and the prevailing ideals of honorable business men.

To be of practical value, instruction in business law must of course train the student to think for himself and to apply general principles to the ever-changing situations in business. Experience has shown that class-room discussion of judicial decisions is a method of almost unique serviceableness for the attainment of these ends, and accordingly the case system of instruction is employed in all the following law courses. It is the policy, however, to eliminate cases which are of merely historical interest in the development of a doctrine of law. Nearly all the cases selected for study are comparatively recent, and in many of them the facts as well as the legal rules are of interest from the standpoint of business.

Commercial Contracts

Dr. Merritt. *Tu., Th., Sat., at* 10.

To introduce students to the study of the law, this course begins with a brief general survey of the nature, function, and sources of the existing law. Thereafter, the course is devoted to a consideration of some of the more fundamental rules of law which govern business transactions.

The most important legal rights and liabilities of the business man are those which arise out of his business agreements. The first large division of study, therefore, has to do with the formation and the forms of agreements. It includes a discussion of offer and acceptance of terms; formal requisites of certain agreements within the Statute of Frauds; special rules relating to agreements in writing; and special rules relating to instruments under seal.

The main part of the course deals with the two principal kinds of business transactions which are based on agreement, — contracts and sales of property, especially sales of goods. The chief emphasis is placed upon the law of contract, and more primarily upon its general principles, although attention is also given to the rights and liabilities that have their foundation in certain special kinds of contracts, notably negotiable instruments and contracts of suretyship. In the discussion of these subjects the objects kept in view are to determine under what circumstances the law insists on a compliance with prescribed formalities in order to give effect to the intentions of the parties to an agreement, to what extent it lays additional obligations upon them irrespective of their intention, and in what respects it imposes limitations on the business man's freedom of action.

Throughout the course students are given opportunity to familiarize themselves with the forms of certain of the more common commercial documents.

The course must be included in the program of study of all candidates for the degree of Master in Business Administration.

Law relating to Business Associations

Dr. Merritt. *Tu., Th., Sat., at* 12.

In many lines of business today it is practically necessary in order to secure a profitable business unit to associate together for that purpose the managerial abilities and the capital contributions of a group of individuals. It is the design of this course to study in detail those rules of law which relate to the activities of such organizations.

It is indispensable to the study of action by groups of men for a common purpose to know the law relating to representative action. Hence, first of all, a careful study is made of the principal topics of the law of agency, including the important state and federal legislation on labor matters.

The main work of the year consists of a detailed comparison with each other of the various kinds of business associations, particularly partnerships and corporations. Among the subjects discussed are the formation of such associations, including a consideration of the position of promoters of a corporation; modes of action by the association; the consequences of unauthorized action on behalf of the association; the interest of the associates in the property of the association; the rights and liabilities of the associates between themselves; and the rights and remedies of creditors of the association.

During the latter weeks of the course, a study is made of legal problems which result from the modern business tendency toward concentration, such as intercorporate relations, holding corporations, consolidation of corporations, and recent judicial interpretation of the Sherman Anti-Trust Act. Attention is also given to the most important provisions of the Federal Trade Commission and Clayton Laws.

The course is open only to students who have passed satisfactorily in Commercial Contracts, or can otherwise satisfy the instructor of their fitness.

Law relating to Banking Operations

Dr. Merritt. Half-course (first half-year). *Mon., Wed., Fri., at* 10.

Those principles of law which govern the more usual transactions in the commercial banking business form the subject-matter of this course. About half the work consists of a study of the law relating to negotiable instruments, considering in detail the requirements of the Negotiable Instruments Law as to their formal requisites; their transfer; the liabilities of the parties; the real and personal defenses available against the holder; and the formalities which are conditions precedent to a right of action against parties secondarily liable.

The latter half of the course is devoted to the law of banking operations proper. It includes the discussion of such questions as the nature of a depositor's contract; rights and liabilities of the bank in making collections; payment of checks; and loans and the various kinds of securities therefor.

The course is open only to students who have passed satisfactorily in Commercial Contracts, or can otherwise satisfy the instructor of their fitness.

Those who have passed satisfactorily in Commercial Contracts are qualified to take the following courses in the Law School:

ADMIRALTY. Professor WESTENGARD.

INSURANCE. Professor WAMBAUGH *and* Asst. Professor CHAFEE.

PUBLIC UTILITIES. Professor FRANKFURTER.

Marketing

THE purchase and sale of merchandise, under modern conditions of production and consumption, has long outgrown the stage of individual bargaining or barter. Large scale production has called for wider and wider markets. Specialized production has similarly necessitated markets larger in scope or more intensively developed. The distance between the consumer and the producer has been lengthened. Conditions of consumption, on the other hand, have also undergone change, due to new conditions of living, new occupations, and the growth of large cities. With these changes in conditions of production and consumption, elaborate and complicated methods of marketing have developed. At the present time they involve some of the most complex problems of business.

In connection with the purchase and sale of raw materials there have developed raw material merchants, commission dealers, auctions, warehouse systems, and future trading systems. In the purchase and sale of manufactured goods the mere mention of brokers, selling agents, wholesalers, jobbers, chain stores, department stores, mail order houses, and "independent" retailers indicates how complicated the distribution of merchandise has become.

Marketing methods have become more complicated, and are constantly undergoing change. A new arrangement of functions is continually taking place. The present agitation for coöperative enterprises is a case in point; the growth of chain stores is another; and the rise of the department store is another case of large importance.

The development of marketing plans and the determination of marketing policies are obviously dependent upon a working familiarity with marketing methods in the form in which they present themselves in the course of ordinary business. Advertising activities, price policies, credit policies, in fact all business operations call for a firm grasp of marketing principles. The acquirement of a familiarity with marketing problems as they have been met and handled in various industries has become an important part of the equipment of any man entering business. This is true of the man entering banking, railroading, accounting or any other specialized branch of business quite as much as it is true of the man engaging in mercantile business itself. The subject of marketing is so fundamentally important that it is given a central position in the work of the School.

Marketing

Asst. Professors CHERINGTON *and* COPELAND *and* Messrs. MCCARTY *and* SHAW; *assisted by* Mr. H. B. GILL. *Mon., Wed., Fri., at* 9.

The principles which underlie marketing methods and policies are studied in this first-year course. The application of these principles is illustrated throughout the course by means of specific examples selected from representative industries and trades. A large amount of information concerning these businesses is thus given incidentally in showing how a selling organization is adjusted to meet complex conditions of production and demand.

The object of all merchandizing effort is to reach the consumer economically and effectively. But how is this to be done? How can demand be created and retained? Through what agencies of distribution is this demand to be satisfied? What are the relations of these agencies to each other and to manufacturers and producers? How are sales and advertising policies to be adjusted to meet these conditions? These questions are discussed from different points of view with reference to the marketing of various commodities. A study is made of the functions, services, and costs of each of the chief types of marketing agencies — retailers, wholesalers, commission merchants, merchandise brokers, coöperative marketing associations, and manufacturers' sales departments; and of the other factors which influence the shaping of marketing policies.

In the section on retail trade, for example, the problems and methods of the so-called regular retailers, department stores, chain stores, manufacturers' retail branches, mail order houses, and coöperative retail societies are discussed. What is the position of each class of retailers in the various lines of trade? Wherein lie their advantages for carrying on particular trades and what are their weaknesses? What are their costs? How have manufacturers been affected by the development of the newer types of retailers and how have they modified their selling policies? Similarly in the section on wholesale trade, a study is made of the problems and policies of wholesalers engaged in such businesses as the grocery, hardware, dry goods, and shoe trades, specialty wholesalers, catalogue wholesalers, coöperative wholesale associations and of manufacturers' wholesale departments.

A similar study is made not only of each of the other marketing agencies employed in the distribution of goods sold at retail, but of the methods of marketing raw materials, semi-manufactured products and machinery, — goods which have a different type of market since they are sold for use in manufacturing.

Careful attention is given to the question of brand development and control, the principles upon which advertising campaigns are planned and carried out, and the determination of price policies.

It is essential in a fundamental course such as this that the interrelation of business activities be duly emphasized. Market considerations influence and in turn are influenced by a wide range of factors. The interdependence between departments and between the individual business and its outside contact necessarily becomes obvious as the course proceeds, but it is of such importance for preserving balance in business judgments that it is made the subject of special discussion in the closing weeks of the course. This discussion affords a definite and ordered approach to the problems of a business manager.

Instruction in English is an integral part of this course. These reports, which are required frequently, are examined by the English instructor for criticism and suggestions on both form and substance. Personal conferences are appointed, at which each student is required to discuss his written work with the instructor. No student is given a passing grade unless he can express his ideas clearly and accurately. This course with its provision for training in English composition is required of all candidates for the degree.

Advertising

Asst. Professor CHERINGTON. Half-course (first half-year). *Hours to be arranged.*

Advertising has assumed an extremely important place in the marketing of many lines of merchandise. Its methods are being improved from year to year. Many of the abuses which earlier existed in connection with it are being corrected. Notwithstanding these changes in its details, however, it has earned general recognition as a permanent and useful method of marketing, supplementing the other sales processes.

The technique of advertising and what might be called its more mechanical sides are still in process of formulation. These it is perhaps not the province of this school to teach at this time. The commercial aspects of the subject, however, are becoming quite clearly defined and it is with them that this course is concerned.

The aim of the course is to develop methods by which an advertiser may choose intelligently the message he wishes to convey, may select the market to which he wishes to appeal, and may then deliver the message to the market in such a way as to make it best supplement other sales efforts. The subjects covered in the course include a discussion of the relation between advertising and selling departments, a consideration of the mediums and rates, the development of methods of market study, the construction of the message, its delivery, and the recording and appraising of direct and indirect returns.

The latter part of the course covering from four to six weeks will be devoted entirely to the planning and execution of advertising campaigns.

Satisfactory completion of the course in Marketing is a necessary prerequisite for this course. It is recommended that the course in Statistics also be taken by those who plan to enter this course.

Marketing Perishable Food Products

Asst. Professor CHERINGTON. Half-course (second half-year). *Hours to be arranged.*

The recent agitation concerning the cost of living has raised the question whether in many parts of the country there is a serious wastage between the production and consumption of perishable foods. The discussion of this subject also has brought out the fact that accurate knowledge of marketing methods in this field is almost exclusively confined to those who are engaged in the food trades, and that much of the general public conception of the problem is vague or inaccurate.

It is evident also that not only the consumer but all who pay wages, whether manufacturers or other employers, have a direct interest in the economy and skill with which perishable foods are supplied to modern cities and towns. For example, it is frequently pointed out that one element in competition which is telling against New England and in favor of the middle west in the development of manufacturers is the fact that perishable foods may be more economically obtained in the middle west. This, it is declared, results in a distinct difference in the purchase power of wages in favor of the west.

Because of its ramifications this subject has assumed a wide interest and apparently a course in the marketing of perishable foods should have value to more than a restricted group of students, and should appeal to students of agriculture, as well as to students of marketing.

The ground covered in the course includes an examination of the existing methods of distributing foods, a study of the packers' branch house systems, a consideration of the work of the commission house and the agent, the jobber, and the retail food trades, the use and possibilities of the auction, coöperative marketing by producers, the methods and value of cold storage systems, the work of the private car lines, freight problems, parcel post marketing, wholesale public markets, retail public markets, and a consideration of the costs and profits under present practice.

A satisfactory completion of the course in Marketing is a prerequisite for this course. It is also recommended that the course in Statistics be taken by those who plan to enter this course.

Retail and Wholesale Store Management

Asst. Professor M. T. Copeland. Half-course (first half-year). *Hours to be arranged.*

There are over half a million retail stores in the United States. Through these stores the bulk of the products of the country are distributed to consumers. Because of the position which these stores occupy in the field of business, a study of their methods and problems, such as is made in this course, is of interest not only to men engaging in retail trade but also to men engaging in manufacturing enterprises and other branches of business. Although much less numerous, in several lines of trade the wholesalers have a prominent place and furnish a necessary link in the marketing process.

What are the principles on which a retail store should be arranged? What accounting methods are used? What is the best buying practice? What stock records are to be kept? How is the selling force to be organized and managed? These are the types of problems which are discussed with reference to stores of different kinds and sizes, including department stores and chain stores.

How is the sales department of a wholesale business organized? How are salesmen selected, trained, supervised, and compensated? How are the buying department and the warehouse organized? What are the selling policies of wholesalers? As in the section on retail store management, such questions as these and also credit policies and accounting methods are discussed for different types of wholesale businesses.

Each student in the course studies these problems at first-hand, under the direction of the instructor, in retail and wholesale establishments. The written reports upon these investigations are discussed at the weekly meetings of the class.

This course is open only to second-year students who have completed Marketing. Inasmuch as many of the problems are statistical in their nature, students are also required to take Business Statistics in order to be admitted to this course.

Purchasing

Asst. Professor M. T. COPELAND. Half-course (second half-year). *Hours to be arranged.*

The administration of purchasing departments in manufacturing establishments and other large enterprises is the subject matter of this course. How are purchasing departments organized ? How are the buying specifications of materials determined ? How is the quantity to buy, the time to buy, and the place to buy determined ? Problems of this type are studied here. Methods of testing seasonal fluctuations of prices and analyses of price movements from the point of view of the purchasing agent are given especial attention.

The course is open only to second-year students who have taken both Marketing and Business Statistics.

Industrial Management

INDUSTRIAL management is the organizing and directing of men and materials in the production of goods and services. The factory system opened the way to large economies of production through its massing of workers in disciplined organization and its new possibilities of standardization and specialization reinforced by mechanical power and machinery.

Manufacturing problems have had more scientific attention than marketing problems. For many years they have received careful study from engineers, factory superintendents, and heads of business enterprises. It is, therefore, less difficult to find material for the scientific study of modern business in the field of production than in that of marketing.

The modern factory is the typical illustration of the application of industrial management, but the principles of industrial management extend beyond manufacturing plants into mercantile establishments, transportation, local public utilities, lumbering, and wherever industrial conditions of grouped laborers exist.

In the introductory course in factory management the general principles underlying sound industrial management are studied and, though the factory naturally furnishes the field of observation, the survey is of high value not merely to those who plan to specialize in factory management but also to all students of business. The second-year courses afford opportunities for detailed study of modern systems of management and for specialized training to men who look forward to a career in manufacturing.

Factory Management

Naval Constructor Coburn *and* Mr. Farquhar, *with the following lecturers:* Messrs. L. P. Alford, J. B. Andrews, C. Day, H.S. Dennison, H. L. Gantt, C. B. Going, H. K. Hathaway, G. Le Clear, E. Morss, *and* J. F. Tobin. Half-course (first half year). *Mon., Wed., Fri.*, 2–3.30.

This is an informative course. It offers preparation to those students who expect to go further into the subject in more advanced courses; and it also offers a general acquaintance with the principles of manufacturing organization, with labor and management problems, which are essential to one intending to enter any part of the field of industrial management. The course consists of lectures by members of the staff of the School, and of lectures by business men, engineers, writers, and representatives of labor. The lecturers from the industrial world discuss generally the broader aspects of management, such as the labor union problem, profit sharing, and welfare work.

The course calls also for field-work. Three inspections of factories are required, each followed by a written report, covering, in detail, the information obtained during the inspection. Great weight is attached to these reports.

The first visit is made in squads of fifteen in each, under the foremanship of a second-year man. The report on this inspection must be made not later than midnight of the date on which the inspection is made. The second visit is made in pairs, two men to a plant. They follow a prepared schedule in securing information regarding the organization, plant, material, labor, accounting, etc. They work together, but submit individual reports. The third inspection is made at a plant different from either of the first two, by each man, individually, following the same schedule; but this inspection is intended to take more time, to be more thorough, and to be covered by a much more comprehensive report.

One of the objects of the course is to acquaint the men with the literature of the subject, which has grown greatly in the last few years. The assigned reading averages about one hundred and fifty pages per week during the half-year, and it is tested by regular, written examinations on the subject-matter in each assignment.

To take this course, previous factory experience or technical training is not necessary.

Factory Practice

Naval Constructor Coburn. Half-course (second half-year). *Hours to be arranged.*

The minor problems of management, such as stores systems, store rooms, tool rooms, tool and machine inspection and maintenance, fire protection, are dealt with in this course.

It is a combination of research work and a series of informative lectures. In the lectures the students are given the principles and details of the best modern practice. In field work they obtain information as to the practices obtaining in the plants which they inspect. They submit reports of their investigations, with criticism and constructive recommendations. They have weekly conferences with the instructor, to discuss the details of their investigations.

It is ordinarily required that applicants for this course shall have satisfactorily completed the course Factory Management; and students intending to take the second-year courses are ordinarily expected to take Factory Practice during the first year.

Factory Management Problems

Naval Constructor Coburn, *and the following lecturers:* Messrs. H. L. Gantt, H. K. Hathaway, R. A. Wentworth, *and* S. E. Thompson. *Hours to be arranged.*

Students are given opportunity to study at first hand the problems of the manager, in organization and management, of manufacturing plants of all descriptions. The School is fortunate in having, as coöperators, a large number of factories in a variety of industries, making it possible for the student to choose the industry in which he is to do his work.

The problems studied are those of general organization, including the delegation of responsibilities and authorities; the analysis, planning and scheduling of work; time study and the standardization of methods and machines; distribution of expense.

The work of research is coupled with a series of informative lectures which develop the underlying principles of organization, control, and management, and show how these principles are worked out in the best practice.

The student examines conditions and practices in the plant to which he is assigned, and makes a written report on each problem, with criticism in the light of the lectures and reading, and recommendations for improvement. Thus the work requires investigation, criticism and constructive thought. The lecturer in weekly individual conferences points the way for the investigation, and by suggestion aids in the constructive work.

When the student's work is good, the coöperators frequently show interest and adopt the suggestions. A clothing factory stores its patterns in the manner recommended by a student in this course; a valve factory has introduced the stores system introduced by another; a wood-working plant re-stored its lumber yard and installed a dry-kiln according to a student's plans and specifications. A factory producing textile machinery submitted its problem of scheduling work. Special attention is being given to the development of a uniform method of storing and accounting for material, and the scheduling of work, in shoe factories.

This course may well be supplemented by the course Taylor System of Management, in which the details of the methods developed by Mr. Taylor and his associates are dealt with.

The entrance requirements for this course are ordinarily (*a*) satisfactory completion of the courses Factory Management, Accounting Principles, Factory Practice, and at least one summer's work in a factory; or (*b*) equivalent experience and reading.

The Taylor System of Management

Mr. FARQUHAR, *with the following lecturers:* Messrs. H. K. HATHAWAY, S. E. THOMPSON, (*others to be arranged*). *Hours to be arranged.*

The recent development in factory administration, popularly known as "scientific management," first took definite form in the work of Mr. Frederick W. Taylor of Philadelphia, and his group of assistants. The Taylor System is today the most complete and consistent example of recent tendencies. In appearance it is radically different from current methods but is in fact logically developed from them.

The work of this course, to which a limited number of students can be admitted, lays stress on the practical application and methods of the Taylor System, basing the discussion upon the development from current methods and the history and literature of the system itself. Special care is taken to emphasize the *principles* of scientific management and to demonstrate the wide applicability of these principles to various manufacturing activities.

For this purpose a considerable proportion of the time of each student is expected to be spent in one or more of the numerous coöperating factories in Boston and vicinity, exemplifying as far as possible, the type of production in which he is most interested. In this work the student has an opportunity to study at first hand the various problems in stores handling, routing, tool room maintenance, and cost keeping, to secure practice in stores, worked material and tool standardization and classification, in making route charts, in devising production systems, and finally, in coöperation with the Harvard University Press and the Rindge Technical School, in making time studies and preparing instruction cards. Opportunity is also presented for visits to the various plants in the vicinity operating under the Taylor System. Each phase of this shop work, upon which written reports are required, is correlated with the lectures, and frequent individual conferences with the instructor enable the student to outline in each case, as part of his constructive work, a procedure in accordance with the principles of scientific management as developed in the lectures and readings.

One of the aims of this course is to teach those detailed methods which make practicable the application of the underlying principles; and it is thus an excellent supplement to the more general course, Factory Management Problems.

The entrance requirements for this course are ordinarily (*a*) satisfactory completion of the courses Factory Management, Accounting Principles, Factory Practice, and at least one summer's work in a factory; or (*b*) equivalent experience and reading.

General Business Problems

THE business executive must center his energies upon the vital problems of management. He can no longer personally supervise the details of production, marketing, and administration, yet he must be familiar with the general workings of every department under his control, in order to be in a position to determine any policies that come to him for final decision. In determining a sales policy, for example, it is necessary to consider the factory operating conditions, the credit, and financial situation, the type of employees, and numerous other factors. The interdependence of these factors is emphasized by their correlation in the courses of this group.

The course Business Statistics studies the technical means whereby department heads and the general management may obtain from all departments of a business statistical information needed for the formulation of their policies.

The actual formulation of these policies in the light of this statistical information and other facts available, including general business considerations, is discussed from the point of view of the management in the course Business Policy. Possible solutions of specific business problems are considered in accordance with the established policies of the management, for example, regarding quality and service in manufacturing or marketing, or both.

The recognition of business as a profession carries with it larger responsibilities to the management. A business firm, for example, cannot be considered as an entity distinct from its own employees or from the life and activities of the community. The Business Policy course, therefore, properly attempts an analysis of the factors and methods entering into the relations of the management with employees, customers, and representatives of other firms, and finally, this course discusses the relation of business enterprise to the state and public opinion.

Business Statistics

Asst. Professor M. T. Copeland. Half-course (first half-year). *Tu., Th., Sat., at* 9.

Business management depends for its success upon a careful analysis of facts; and many of these facts can best be presented in statistical form. In practically every kind of business and by establishments of all sizes, properly selected statistics can be advantageously utilized. Statistics are used in establishing standards, testing efficiency, detecting waste, and furnishing a guide for future plans. Opportunity is offered in this course for studying the principles which are to be observed in collecting, presenting, and interpreting statistics for business purposes. Accounting and cost determination are considered only in so far as the methods of analysis and of establishment of standards are essentially statistical in their nature. The work is closely correlated, without duplication, with that in many other courses in the School.

The application of sound statistical theory and practice to actual business problems is the object sought. A critical examination is made of methods of preparing statistical indices of business conditions and of the commercial, industrial, and financial statistics used for that purpose. Along with this subject and immediately subsequent to its conclusion, the leading principles of theory and method, which form the ground-work for the whole course, are outlined. Attention is then turned to the application of statistics to specific commercial and manufacturing problems. How is the capacity of a prospective market to be estimated and sales quotas established? Is the volume of trade in present markets showing proper expansion? What sales records and what stock records are needed by the manufacturer and the wholesaler? What statistics can the advertising manager use for selecting mediums and checking up results? How can statistics be utilized in a retail store? What purchasing records are to be kept by the manufacturer, and how is it to be determined whether or not purchases are being made at the most opportune times? What use is to be made of the reports of current operations in the factory? Finally, which of these statistics ought to be presented to the chief executive and in what form? Such questions as these are discussed, using specific examples drawn from different lines of trade and for establishments of various sizes.

The preparation of reports and charts gives essential practice in collecting and handling statistics and a knowledge of common abuses and errors to avoid.

Business Policy

Professors Gay, Cole, Sprague, *and* Cunningham, *with the following lecturers:* Messrs. R. B. Carter, H. Coonley, W. H. Cottingham, H. S. Dennison, P. E. Fitzpatrick, C. H. Jones, H. P. Kendall, J. S. Lawrence, H. W. Mason, E. G. Preston, W. F. Severn, J. R. Simpson *and* T. W. Slocum. *Mon., Wed., Fri., at* 9.

Second-year men bring to bear in this course on actual business problems their knowledge of business acquired in the School and elsewhere.

The object is to give these men who are college graduates with a year's training in the School and with at least a little actual business experience, a view of business from the point of view of the management. This study usually precedes, by several years, the students' entrance into positions of executive responsibility, but it shows them more clearly at the start their place in any business organization, and it gives them an opportunity to apply their own information and judgment to managerial problems. The substitution of careful, conscious analysis of managerial problems for unconscious analysis is an underlying purpose of the course.

An analysis of any business problem shows not only its relation to other problems in the same group, but also the intimate connection of groups. For example, not only is any problem of factory management related to other problems in the factory, and any problem of selling related to other problems in the sales department, but also these groups of problems are interdependent. Few problems in business are purely intra-departmental. Furthermore, within each department there must be preserved a uniform principle of balance in accord with the underlying policies of the business as a whole.

It is important for the student to realize that a business organization is something more than a well-contrived mechanism, that it is also an interplay of intangible personal motives. These affect the internal relations of the various groups of workers in an individual concern and also external relations of the business to public opinion and its expression in custom, law, and governmental activities. In the latter part of the course, therefore, the social factors in business enterprize are examined.

A special feature of the course is the discussion with business men, in the class-room and outside, of a series of actual problems which they have considered and of the policies which have determined their decisions.

A written report is required of every student in the second half-year. Those students whose work has been of high quality during the first half-year are assigned to advisers conversant with the subjects in which the students are specializing. The advisers are business men in Boston and vicinity, each of whom has agreed to give a minimum of half an hour a week to one student of this course. This course is open only to regular second-year men. With the consent of the instructor it may be taken during the first half-year as a half-course.

Foreign Trade

THE war has had two marked effects on American foreign trade. The first is the serious alteration of its volume and character growing out of the disturbance of economic conditions here and in Europe. It is probable that the export trade in American manufactures will assume a permanently increased importance.

A second effect of the war upon American foreign trade is the curtailment of the supply of young Englishmen and

Germans who formerly were available on favorable terms as recruits in the service of American concerns engaged in either importing or exporting.

These conditions have turned the attention of American houses in the foreign trade to the question of securing young Americans for this work. The foreign trade field therefore is more attractive as an opening for the American college man than it ever was before.

Our foreign trade involves many difficult problems, the solution of which requires familiarity with business conditions in foreign countries as well as in our own and with international trading methods. In the import trade direct foreign purchasing by manufacturers, import houses, and department stores, for example, calls for a wide knowledge of the sources whence the goods are to be obtained, of the agencies by which the trade is carried on, and of other features of the commercial mechanism. This is distinctly more urgent than was the case when the trade was handled more largely by commission houses.

Some American manufacturers and some American merchant houses already had made remarkable records of success even before the war conditions developed. But as a whole, American manufacturers and merchants have not put forth the serious and consistent efforts necessary for building up an export trade in manufactured goods. It is becoming increasingly clear, however, that foreign markets for manufactured products cannot be secured by following the policies of the exporters of raw materials. Manufactured wares must not only be offered for sale; they must be pushed and pushed intelligently with due reference to distributing methods and the marketing conditions. Merchandising methods are, in some lines, quite different in the United States and foreign countries.

Both import and export trades are studied in these courses. But the greater emphasis is laid on means of placing goods in foreign markets, the competition which is likely to be encountered, the probable demand for various products, and how these products are actually to be distributed to the foreign consumers. Opportunities for capital investment in foreign countries are also considered. The courses are informative in that they describe the geographical, social, and industrial conditions which form the essential background of international commerce. They are analytical in their search for the reasons why particular methods are used and why special developments are taking place in special trades.

The analogies and contrasts with the merchandising methods in the domestic trade of the United States make such study profitable even to students who do not plan to enter the import or export trade.

Foreign Trade Methods

Asst. Professor CHERINGTON. Half-course (first half-year). *Mon., Wed., Fri.*, 4.30-6.

The central question in this course is: How is American foreign trade carried on ? In import trade, for instance, the ground covered includes such matters as the selection of sources, establishment of connections, internal organization, and the development of markets; and in the export trade, the selection of markets, the selection of exporting methods, the determination of export price policies, relations with commission houses and agents, and problems of order execution, such as packing, shipping, insurance, forwarding, exchange, credits, and collections.

European Trade

Half-course (first half-year). *Tu., Th., Sat. at* 9.

Although European trade has been dislocated by the war, European manufacturers are still our greatest competitors in foreign markets. Europe, furthermore, has always been the largest market for our own products and the source of many of our imports. In the years prior to the war about one-half of the total quantity of merchandise annually imported into the United States came from Europe. To Europe an even greater proportion of our exports were sent. This trade was constantly expanding before the war began and when conditions have again become normal it will doubtless continue to expand beyond the old level. Although conditions of demand and production have been so modified by the war that the volume of trade in individual commodities has been permanently changed, it may be expected, nevertheless, that eventually trade will tend to resume its old channels; old business relationships will probably be restored and the methods by which trade has been handled in the past will be resumed. Consequently the methods and agencies whereby European foreign trade is normally carried on can profitably be studied even under the abnormal conditions now prevailing.

After a brief introductory survey of the general geographical, political, and social conditions which influence trade in the chief European countries, an analysis is made in this course of the methods by which European import and export trade is carried on with the United States and with other countries. Import trade and export trade are considered separately. The services and functions of the various marketing agencies employed in these trades are studied by means of specific examples selected from typical industries and businesses. Incidentally much information is given regarding resources and conditions of production.

Under the subject of export trade, for example, such questions as the following are discussed: — What is the position of export merchants in the textile trades? Under what conditions are commission merchants employed? How is the trade with foreign "buyers" handled? Why have kartells been organized in certain industries and how do these organizations affect foreign trade methods? What are the credit methods of European exporters?

The subject of European import trade is subdivided into two parts, — (1) trade in goods sold to manufacturers, and (2) trade in goods to be sold at retail. The former includes the trade in raw materials, semi-manufactured goods, and machinery — a trade which, in the main, is highly standardized in well-established channels. The trade in goods to be sold at retail is less highly developed, less standardized, and greatly complicated by the problems of wholesale and retail distribution. Under each of these subdivisions the functions and methods of the various agencies engaged in the trade are studied. Particular attention is given to the problems of retail distribution in Europe, since the competition between single stores, chain stores, department stores, and coöperative societies is especially keen and the selection of importing agencies and the determination of marketing policies is dependent upon the retail outlets which it is expected to utilize. The discussion of these problems is also of interest to students of domestic marketing methods in the United States.

Although ample opportunity is offered for reading French and German, and a reading knowledge of these languages is strongly recommended, their use is not required in the regular work of the course.

Latin-American Trade Problems

Dr. Klein. Half-course (second half-year). *Mon.*, *Wed.*, *Fri.*, 2.30.

The foreign trade of the United States is increasing rapidly, and it is increasing with Latin-America more rapidly than with any other part of the world. The impetus given by the Panama Canal to this trade and to the development of closer relations of all kinds between the United States and a large part of Latin-America has been still further increased by the European war to include a much larger part of Latin-America. Fresh interest and greater attention are consequently being given to the problems involved in this trade extension. Problems of selling methods, trade organization, arranging of credits, financing of transactions, transportation of goods, combination to secure trade more economically, tariff barriers, and the like have become subjects of general discussion.

In addition to the study of these topics of exporting to the Latin-American field, an analysis is made in this course of the problems of importing the chief products of the countries under discussion. Special attention is given to the methods and policies of firms engaged in exploiting Latin-American resources and marketing such commodities as sisal, crude oil, sugar, nitrate, copper, quebracho, rubber, coffee, wool and beef.

As the course is devoted exclusively to trade problems some knowledge of geographic and economic conditions and possibilities of the various regions of Latin-America is assumed. A reading knowledge of Spanish, French and German, though highly desirable, is not required.

Attention is called to the following courses offered by the Faculty of Arts and Sciences: —

French 3. French Composition (*elementary course*). Mr. Raiche.

French 4 ^{1}*hf*. French Composition (*intermediate course*). Mr. Mercier.

French 5 ^{2}*hf*. French Composition (*advanced course*). Mr. Mercier.

Spanish 7 ^{1}*hf*. Spanish Composition (*elementary course*). Asst. Professor Whittem.

German *H*^{2} *hf*. Practice in Speaking and Writing German (*second course*). Dr. Shoenemann.

German 18 ^{1}*hf*. German Grammar and Practice in Writing German (*advanced course*). Associate Professor Bierwirth.

Banking and Finance

THE organization and operation of banking and other financial institutions and the financial policy of corporations form the subject-matter of the courses included in this group. Experience alone can give facility in the details of routine work; but these courses will be found useful in enabling the student who has followed them to see beyond the limits imposed by the minute division of routine labor in large banks or by departmental organization. The student will secure knowledge which should make his future work more interesting to himself at the outset and in no long time more effective through the exercise of trained observation upon the particular task which he performs and upon its relation to the other work going on around him.

It is the chief purpose to offer a training to men who plan to enter the business of commercial or investment banking but since it is sought to provide the basis for the formation of sound and conservative judgment regarding financial matters, some one or more of the courses may often advantageously form part of the plan of study for other students whose primary interest is in a different kind of business.

Banking (First-year course)

Professor Sprague. *Tu., Th., and Sat., at* 11.

Subjects which are common to all banks, including organization, the duties of the various officers, and an analysis of each item of banking resources and liabilities, are first studied. The history and working of the English banking system are examined in considerable detail. A general survey of banking in France and Germany follows. In connection with this part of the course each student prepares a statistical and descriptive report upon the London money market during a period of moderate financial strain, based upon data collected from financial journals and other sources of current information.

More than half of the course is devoted to banking in the United States. The legal and other differences between federal reserve, national banks, state banks, and trust companies are considered, but, as in the case of England, emphasis is laid upon the working of the system as a whole. Analysis of the different kinds of loans, the functions of the note broker, and the relations between banks in reserve cities and other banks is followed by a detailed examination of the working of the New York money market in relation to the rest of the United States and to the money markets of other countries. So much of foreign exchange is taken up as seems necessary for a proper understanding of banking problems. The development of the federal reserve banks and modifications in banking practice which their operations are bringing about are given detailed consideration. Reports on the New York money market similar in scope to those upon the London market are prepared by the students. Experienced bankers deliver some special lectures.

Banking (Second-year course)

Professor Sprague. *Mon., Wed., at* 11.

This course is intended to cover in a practical and detailed fashion a variety of selected topics related to banking in the United States. Among the subjects to be considered are the analysis of credits, money rates, collections and transits, foreign exchange, real estate loans and rural credits. Each student is given an opportunity for special investigation of those subjects which have a direct bearing upon that branch of the banking business which he plans to enter.

Investments

Mr. Moors. Half-course (second half-year). *Tu., Th., at* 2.30.

In order to give the basis for forming a sound and conservative judgment in investment, this course discusses such subjects as the various kinds of investment suitable for different persons: bonds and stocks; savings bank and trust investments; the factors constituting the value of securities; the history of typical securities; stock exchanges; brokerage, legitimate and illegitimate; the mechanism of the money market; booms and panics; the economic functions and dangers of speculation. On the part of the class, considerable practice work is required in the analysis of corporation reports and similar material.

The Financial Management of Industrial Corporations

Professor Sprague. Half-course (first half-year). *Tu., Th., and (at the pleasure of the instructor) Sat., at* 10.

After a preliminary discussion of the function of the corporation in the present economic organization of society, there follows a detailed examination, with illustrations from concrete business experience, of the various phases of corporate activity. Among the subjects treated are the following: — in which state shall incorporation be made; principles and practice governing the calculation of profits — depreciation, reserve, dividends; the various financial obligations of corporations; methods of acquiring new capital; relations with banks; the motives and results of consolidation; bankruptcy and receiverships; and finally, control of corporations by the state and federal governments. While the course is mainly concerned with industrial corporations, the experience of railroad and other public service companies is drawn upon to illustrate some of the topics considered.

Each student makes a study of a single industry taken as a whole, giving especial attention to such matters as steadiness of demand for product, terms of purchasing material and payment for product, capital required for a given output, and methods of marketing. He then analyzes the financial policy and experience of a number of corporations engaged in his particular industry. Where a combination has been formed in the particular industry studied, the student endeavors to determine how this form of organization has influenced progressive advance in the industry and in what ways, if any, it has made possible economies in production and in marketing.

This course is ordinarily open only to students who have taken Accounting Principles and Investments, or their equivalents.

The Financial Management of Railroad Companies

Professor SPRAGUE. Half-course (second half-year). *Tu., Th., and (at the pleasure of the instructor) Sat., at* 10.

The subject-matter of this course, the railroads, furnishes a particularly satisfactory field for the detailed and concrete study of corporation finance. This is partly because railroad experience extends over a long period and because the data are abundant and, in recent years, have been put together in accordance with uniform requirements. Further, it may be added, much that is generally accepted as sound in financial practice, and also present methods of marketing securities, are largely a result of experience with the railroads. In connection, therefore, with the railroads many subjects such as varieties of securities, underwriting, and reorganizations can most profitably be considered.

Railroad reports are analyzed in detail, in order to familiarize the students with the nature and significance of the various standard methods of measuring railroad results and to make clear the many qualifications which must be borne in mind in applying these standards to the case of any particular road. Each student prepares reports upon the financial policy and experience of two railroads, covering a period of at least ten years.

This course is open to students in the Graduate School of Business Administration who have satisfactorily completed The Financial Management of Industrial Corporations.

Attention is called to the following course offered by this School (but omitted in 1917–18): —

The Financial Management of Local Public Service Corporations.

Transportation

THE usual experience of the young man who enters railroad work is to find it so highly specialized departmentally that little opportunity is afforded him to gain information concerning the workings of the other departments. A broad knowledge of the whole field must, therefore, be of distinct advantage at the start, because it enables him better to understand the function of his own department and its relation to the whole transportation organization. The classroom cannot take the place of practical experience, nor can the courses " teach railroading." They can, however, make it easier for the graduate to apply his practical experience more intelligently and to better advantage.

The course in Railroad Organization, while intended primarily as the introductory course for men who are to take up railroad work, is designed also (like the course in Railroad Traffic and Rate-Making) to afford information which will be of interest to business men in general in their relations with railroads. The other railroad courses are more specialized. During his first year in the School the railroad student is advised to take Railroad Operation (in addition to the three required courses) so as to be prepared in his second year to do the advanced work in Analysis of Railroad Problems, and to specialize further by taking the courses in Railroad Rate-Making, Railroad Organization, and Railroad Accounting.

In several fields of business activity, a knowledge of water transportation is useful, and, in some, indispensable. The half-course in Water Transportation is especially recommended to those who plan to enter the steamship business, shipbuilding, foreign trade, marine insurance, ship brokerage, or any business which depends largely upon water carriers for transportation of its raw materials or finished product. The course in Water Transportation is also intended to furnish those who enter railroad work with a knowledge of the relations between railroads and water carriers. This course also deals with problems connected with port terminal facilities — a subject which is receiving greater attention from chambers of commerce and other local trade organizations.

Railroad Organization

Professor Cunningham. Half-course (first half-year). *Mon., Wed., Fri., at* 3.30.

It is the aim of this course to give a broad survey of the administrative organization of railroads and to afford a fairly close view of the relations between railroads and their employees. While designed primarily for men who are to enter railroad service, the course is of interest to the student who is to engage in any commercial or industrial work which may be linked more or less closely with transportation agencies.

As a groundwork, the course first reviews the early history of canals and railroads of the world, and briefly traces their development. Then, in order to inform the student with respect to modern requirements, the successive steps in the promotion, financing, construction and organization of a new railroad project are traced. This embraces a consideration of such factors as sources of traffic, rise and fall, and curvature, which determine in the first place whether the road shall be built at all, and in the second place, if built, which of the available routes shall be selected.

Then comes a study of railroad organization. Each department is taken up in turn. The functions of each, the divisions in authority and responsibility of the various general and division officers, the distinction between line and staff, and the relations of these officers not only to their own but as well to other departments are carefully considered. To give point to general principles, the organization charts of the principal railroads, both at home and abroad, are studied, and the reasons for differences in form and practice are pointed out. This embraces a discussion of the relative advantages and disadvantages of the departmental and the divisional types and a contrast of American with European organization of railroad forces.

Considerable attention is then given to the relations between railroads and their employees. The development and present organization of the brotherhoods and other railroad labor unions are discussed, and a study made of the existing wage schedules or working agreements, general rules and legislation affecting employment, arbitration of disputes, and similar matters.

A discussion of internal organization would be incomplete without some consideration of types of external organizations, or the relations of railroads to each other. The modern tendency is distinctly towards railroads working together rather than independently, and a study of the machinery by which their actions are coördinated is of sufficient interest to call for a careful study of the functions and accomplishments of the important national and international railroad associations.

Railroad Accounting

Professor Cunningham. Half-course (second half-year). *Mon., Wed., Fri., at* 3.30.

This course is designed to follow Railroad Organization, and, in connection with it, to afford men who intend to enter railroad service a broad understanding of the accounting and statistical organization of a modern railroad.

No matter in what department the graduate begins his railroad service, a knowledge of railroad accounting is essential to a clear understanding of the public returns and the many special statistics which are made up by the accounting department for the information of the company's officers. Special emphasis, therefore, is placed on the study of the workings of the treasury and accounting departments, including accounting and auditing methods.

Following a survey of the development of accounting practice as it existed prior to 1887, when the Interstate Commerce Commission began to prescribe uniform accounting rules, the various classifications and orders of the Commission are critically studied, including the important cases where the Commission's rulings have been tested in the Courts. Throughout the discussion the purpose is to look at fundamental principles rather than at detail. Yet it is important that the student should be familiar with certain details of station accounts and should understand the bases and purposes of the many reports made by agents and conductors as to station and train performance, and by foremen, storekeepers, pay-roll clerks and other division officials as to expenditures for materials and labor. These transactions are traced from their sources to the general books of the company, and from these to the monthly and annual reports which show the results of operation and the financial condition of the company.

The distinction between accounts and statistics is next considered. The importance of such fundamental statistics as ton- and passenger-mile receipts and train-mile costs is emphasized and upon these as a foundation is built the superstructure of detail by which the responsible officers may keep closely in touch with every detail of operation and gauge its efficiency.

Railroad Operation

Professor CUNNINGHAM. *Mon., Wed., and (at the pleasure of the instructor) Fri., at* 2.30.

This course is designed to afford a general knowledge of the working of railroads, particularly in the operating department. But as the typical American railroad, organized on the divisional plan, places upon the superintendent of a division certain responsibilities for maintenance of way, structures, and rolling stock, it is essential that the young man who enters the operating department should have a working familiarity with the administrative features of maintenance, as well as an intimate knowledge of operation. To that end, the course begins with a non-technical survey of the physical characteristics and maintenance of roadway and structures — ties, ballast, rail, rail fastenings — and a study of the relation between gradients, curvature, and distance and operating efficiency. The design and maintenance of locomotives and cars are similarly dealt with, particularly from the viewpoint of the manager who is responsible for the efficient utilization of equipment as well as for the cost of maintaining it.

The lectures are illustrated by diagrams, charts, photographs, and models, with reference to the recommended standards. Opportunity is afforded by actual inspection on New England lines to observe the features studied in the class-room.

Supplementing that part of the course in Railroad Organization which deals with the relations between the railroads and their employees, attention is given to the rules in the working agreements (such as the rule pertaining to promotion by seniority) which affect operating results. A study is made also of the various physical, educational, and service tests, and other methods of maintaining discipline, including a consideration of the systems of discipline such as by record, by suspension, or by a combination of both.

Then follows a critical study of the Standard Code of Train Rules and a discussion of the general principles applying to time tables and passenger and freight train service. Particular attention is given to the freight service, including a somewhat detailed consideration of the relation between locomotive tractive force, tonnage ratings, and train performance.

The recent traffic congestions and shortage of freight car equipment emphasize the importance of the next subject — utilization of freight cars, including a consideration of the existing per diem rules and the proposals for national pooling of such equipment. Then comes a discussion of train accidents, their nature, frequency, causes, and means of prevention. This leads to a study of block signals and interlocking, in which each type of signal and similar device, its features of maintenance and operation, are taken up.

The concluding section of the course deals with the design and operation of yards and terminals, and freight and passenger stations. The importance of the terminal problem is emphasized in studying its effect on the train service, the capacity of the road, and the operating costs.

Discussion and reports by students supplement the instruction by lectures. Lectures on special topics are given by railroad officials who are experts in those fields.

Railroad Operating Problems

Professor Cunningham. *Mon., Wed., and (at the pleasure of the instructor) Fri., at* 11.

This course is designed for second-year students who have taken Railroad Operation and Railroad Accounting. It supplements the first-year course with specific problems for analysis and conference. It is essentially a course in statistical analysis and requires much independent research and frequent reports.

Special attention is given to the measures of efficiency in maintenance of way, structures, and equipment; and of the operation of stations, yards, and trains; including a detailed study of tonnage ratings and the freight train load.

The problems to be selected are determined by the preference of the student for certain lines of railroad work and his plans for the future, but emphasis is placed throughout the course on statistical and analytical methods.

Railroad Rate-Making

Mr. Rich *and the following lecturers:* Messrs. H. C. Barlow, W. H. Chandler, G. H. Eaton, Halford Erickson, G. L. Graham, W. T. La Moure, D. T. Lawrence, *and* W. P. Libby. *Tu., and Th.,* 2.30–4.30.

The course deals with the economic, practical and legal aspects of railroad rate-making. The subject of the reasonableness of rates as a whole is discussed with especial reference to the valuation now being made by the Interstate Commerce Commission. Questions of railroad finance are studied in so far as adequacy of return is an influence in determining the proper method of financing.

The numerous questions relating to discriminations are studied in connection with the Interstate Commerce Act and the decisions of the Commission and the Courts under the act. Such topics as the following are also discussed: classification, port and inland differentials; industrial railroads; transit privileges; lawful and unlawful allowances; lawful and unlawful preferences; practice and procedure before the Commission.

Especial attention is given to the principles underlying competitive and non-competitive rate-making. Rate structures throughout the country are studied. Specific rate problems will be submitted for consideration, and those will be as far as possible actual cases pending before public tribunals.

The conflicts between state and Federal control as illustrated by the Minnesota and Shreveport cases, and possible remedies; also the inter-relation of rates will be considered.

Lectures will be given during the year by men engaged in the traffic work of railroads, industries and trade organizations.

The course is intended primarily for those entering railroad service but will be of value to those who expect to engage in business or to enter Chamber of Commerce work.

Attention is called to the following courses offered by the Faculty of Arts and Sciences: —

French 3. French Composition (*elementary course*). Mr. Raiche.

French 4 ^{1}*hf*. French Composition (*intermediate course*). Mr. Mercier.

French 5 ^{2}*hf*. French Composition (*advanced course*). Mr. Mercier.

Spanish 7 ^{1}*hf*. Spanish Composition (*elementary course*). Asst. Professor Whittem.

German *H*^{2} *hf*. Practice in Speaking and Writing German (*second course*). Dr. Shoenemann.

German 18 ^{1}*hf*. German Grammar and Practice in Writing German (*advanced course*). Associate Professor Bierwirth.

Banking and Finance

THE organization and operation of banking and other financial institutions and the financial policy of corporations form the subject-matter of the courses included in this group. Experience alone can give facility in the details of routine work; but these courses will be found useful in enabling the student who has followed them to see beyond the limits imposed by the minute division of routine labor in large banks or by departmental organization. The student will secure knowledge which should make his future work more interesting to himself at the outset and in no long time more effective through the exercise of trained observation upon the particular task which he performs and upon its relation to the other work going on around him.

It is the chief purpose to offer a training to men who plan to enter the business of commercial or investment banking but since it is sought to provide the basis for the formation of sound and conservative judgment regarding financial matters, some one or more of the courses may often advantageously form part of the plan of study for other students whose primary interest is in a different kind of business.

Banking (First-year course)

Professor Sprague. *Tu., Th., and Sat., at* 11.

Subjects which are common to all banks, including organization, the duties of the various officers, and an analysis of each item of banking resources and liabilities, are first studied. The history and working of the English banking system are examined in considerable detail. A general survey of banking in France and Germany follows. In connection with this part of the course each student prepares a statistical and descriptive report upon the London money market during a period of moderate financial strain, based upon data collected from financial journals and other sources of current information.

More than half of the course is devoted to banking in the United States. The legal and other differences between federal reserve, national banks, state banks, and trust companies are considered, but, as in the case of England, emphasis is laid upon the working of the system as a whole. Analysis of the different kinds of loans, the functions of the note broker, and the relations between banks in reserve cities and other banks is followed by a detailed examination of the working of the New York money market in relation to the rest of the United States and to the money markets of other countries. So much of foreign exchange is taken up as seems necessary for a proper understanding of banking problems. The development of the federal reserve banks and modifications in banking practice which their operations are bringing about are given detailed consideration. Reports on the New York money market similar in scope to those upon the London market are prepared by the students. Experienced bankers deliver some special lectures.

Banking (Second-year course)

Professor Sprague. *Mon., Wed., at* 11.

This course is intended to cover in a practical and detailed fashion a variety of selected topics related to banking in the United States. Among the subjects to be considered are the analysis of credits, money rates, collections and transits, foreign exchange, real estate loans and rural credits. Each student is given an opportunity for special investigation of those subjects which have a direct bearing upon that branch of the banking business which he plans to enter.

Investments

Mr. Moors. Half-course (second half-year). *Tu., Th., at* 2.30.

In order to give the basis for forming a sound and conservative judgment in investment, this course discusses such subjects as the various kinds of investment suitable for different persons: bonds and stocks; savings bank and trust investments; the factors constituting the value of securities; the history of typical securities; stock exchanges; brokerage, legitimate and illegitimate; the mechanism of the money market; booms and panics; the economic functions and dangers of speculation. On the part of the class, considerable practice work is required in the analysis of corporation reports and similar material.

The Financial Management of Industrial Corporations

Professor Sprague. Half-course (first half-year). *Tu., Th., and (at the pleasure of the instructor) Sat., at* 10.

After a preliminary discussion of the function of the corporation in the present economic organization of society, there follows a detailed examination, with illustrations from concrete business experience, of the various phases of corporate activity. Among the subjects treated are the following: — in which state shall incorporation be made; principles and practice governing the calculation of profits — depreciation, reserve, dividends; the various financial obligations of corporations; methods of acquiring new capital; relations with banks; the motives and results of consolidation; bankruptcy and receiverships; and finally, control of corporations by the state and federal governments. While the course is mainly concerned with industrial corporations, the experience of railroad and other public service companies is drawn upon to illustrate some of the topics considered.

Each student makes a study of a single industry taken as a whole, giving especial attention to such matters as steadiness of demand for product, terms of purchasing material and payment for product, capital required for a given output, and methods of marketing. He then analyzes the financial policy and experience of a number of corporations engaged in his particular industry. Where a combination has been formed in the particular industry studied, the student endeavors to determine how this form of organization has influenced progressive advance in the industry and in what ways, if any, it has made possible economies in production and in marketing.

This course is ordinarily open only to students who have taken Accounting Principles and Investments, or their equivalents.

The Financial Management of Railroad Companies

Professor Sprague. Half-course (second half-year). *Tu., Th., and (at the pleasure of the instructor) Sat., at* 10.

The subject-matter of this course, the railroads, furnishes a particularly satisfactory field for the detailed and concrete study of corporation finance. This is partly because railroad experience extends over a long period and because the data are abundant and, in recent years, have been put together in accordance with uniform requirements. Further, it may be added, much that is generally accepted as sound in financial practice, and also present methods of marketing securities, are largely a result of experience with the railroads. In connection, therefore, with the railroads many subjects such as varieties of securities, underwriting, and reorganizations can most profitably be considered.

Railroad reports are analyzed in detail, in order to familiarize the students with the nature and significance of the various standard methods of measuring railroad results and to make clear the many qualifications which must be borne in mind in applying these standards to the case of any particular road. Each student prepares reports upon the financial policy and experience of two railroads, covering a period of at least ten years.

This course is open to students in the Graduate School of Business Administration who have satisfactorily completed The Financial Management of Industrial Corporations.

Attention is called to the following course offered by this School (but omitted in 1917–18): —

The Financial Management of Local Public Service Corporations.

management and the systematic arrangement of an agent's work are treated at length.

This course requires no previous knowledge of life insurance and, if desired, may be taken in connection with the course on Life Insurance Principles.

Actuarial Practice

Mr. Dow *and* Dr. L. R. Ford. Half-course (second half-year). *Two afternoon meetings a week; hours to be arranged.*

Because of the advanced mathematical and theoretical standpoint from which the subject of life insurance is treated in this course the student should have taken courses in higher algebra and differential and integral calculus and should have some elementary knowledge of life insurance. The following subjects are treated: the construction and graduation of mortality tables, the valuation of the liabilities and assets of life insurance companies, the classification of risks, the insurance of under-average lives and extra premiums for special hazard, and the practical treatment of cases of alteration and surrender of life insurance contracts. In connection with the proper mathematical courses, the subjects are such as are required for admission as associate in the Actuarial Society of America. This course can be taken in connection with the elementary course in life insurance.

Attention is called to the following courses in Harvard College, open to students in this School who are studying to become actuaries: —

Mathematics *A*. Trigonometry and Analytic Geometry and Introduction to Calculus (or Mathematics *C* for students who have already studied Trigonometry).

Mathematics *D*. Algebra. *Half-course (second half-year).*

Mathematics 2. Differential and Integral Calculus; Analytic Geometry.

Mathematics 5. Differential and Integral Calculus (*second course*).

Mathematics 9. Probability. *Half-course (second half-year).*

Mathematics 21. Finite Differences and Difference Equations. *Half-course (second half-year).*

Mathematics 9 and 21 are given in alternate years. The other courses are given every year.

Printing and Publishing

THE need for trained men in the printing business is far greater today than it was a generation ago. Then the implements of the trade were few and simple. There were only a few styles of type, only three or four kinds of presses, and comparatively few varieties of paper and ink. The work was mostly done by hand and the processes were simple and easily learned. A young man had ample opportunity to learn the entire trade and to get some business training as well in the course of a few years.

Today the industry has become so specialized that a workman cannot expect to become thoroughly familiar with more than a few of the various processes involved. There is so much to learn that one can hardly work up through the many departments of the shop into the commercial side of the business with hope of large success. Yet this commercial side requires trained men as never before.

The need for a knowledge of the different processes involved in the production of various kinds of printed matter and of their relative costs together with some knowledge of how to arrange printed matter effectively is also recognized by every one who enters the business field, especially advertising.

To meet the need for men qualified to fill administrative positions in the printing business the following two courses are offered in connection with others given in the School. To meet the need of those who desire a knowledge of printing such as will be valuable in the advertising and general business field the first half-year of the first course is offered; a complete program of instruction for those who intend to make printing their professional business career, in addition to the courses here listed, includes courses in the principles of accounting, industrial accounting, factory management, marketing, business policy and commercial law.

Printing and Publishing (First-year course)

Mr. C. C. LANE, *assisted by Mr.* STONE, *and the following lecturers:* Messrs. H. L. BAKER, A. E. BARTER, W. J. BERWICK, L. P. CUDWORTH, A. W. ELSON, A. W. FINLAY, F. T. HULL, A. D. LITTLE, J. H. MCFARLAND, E. E. NELSON, J. C. OSWALD, CHARLES SCHWEINLER, DONALD SCOTT, W. A. SPURRIER, *and* D. B. UPDIKE. *Tu., Th.,* 4.30–6, *and a third hour at the pleasure of the instructor.*

The object of this course is to provide an introduction to the technique of printing. As a full course it gives the student a fairly comprehensive knowledge of the various operations and processes involved in the manufacture of a book, shows him the reason for each step that is taken, and gives him an opportunity to apply in practice what he learns in the class-room.

As a half-course, the first half-year acquaints the student with the various fundamental processes involved in the production of printed matter and furnishes him with a nomenclature that will enable him later to express intelligently to workmen the ideas that he desires to have carried out. The following subjects are among those considered: what type is, its material, founding, sizes, and measurements; principles governing good composition; electrotyping; printing processes; ink, its composition and adaptability; the physical qualities of paper and its selection for specified work; printing office mathematics; binding, its general principles and as applied to book and pamphlet processes; the reproducing processes; principles of design, decoration, and ornamentation; commercial, catalogue, and advertising typography.

The second half-year is devoted to the study of the problems peculiar to the printing industry itself, and as a continuation of the first half-year gives a firm elementary basis for the detailed studies and investigations of the second-year course. Among the subjects considered are: the historical development of type forms; the selection of proper types for the composing room; printing-plant organization and management; routing; stock and supply departments; power; cost accounting; estimating; special printing-office machinery, and publishing.

The lectures are supplemented by outside reading and visits to see in actual operation the processes discussed in the class-room. Conferences are regularly conducted on the reading and the solution of practical problems.

Rooms have been designated in the new building of the Harvard University Press for the meetings of the course. Thus opportunity is given in a modern printing and publishing plant to work out practically the assigned problems.

An optional visit, open to those who take the work of the first half-year as well as to those who take the full course, is arranged during the spring recess to visit typical printing and publishing houses and also plants of allied industries in New York City. Contingent upon a sufficient number so desiring, the trip will be extended to include the large plants at Philadelphia and the Government Printing Office and Bureau of Engraving at Washington.

Throughout the course the aim is to direct attention to fundamental principles, and no attempt is made to consider the innumerable details which the workman must learn in the shop. With the consent of the instructor, this course may be taken during the first half-year as a half-course.

Printing and Publishing (Second-year course)

Messrs. C. C. LANE, W. A. DWIGGINS, *and* W. M. STONE. *Two meetings a week. Hours to be arranged.*

Intended to give the student practical experience in solving the problems which the superintendent or manager of a printing office must face, this course is carried on in connection with an established plant which is being reorganized in accordance with the best principles of shop management. Throughout the work theory and practice are closely related. The student is taught to design type pages of various kinds and to work out some of the underlying principles of design and harmony in type forms. He is given practice in preparing copy for the printer, in making out specifications, and in estimating costs. He studies the comparative effectiveness of machines and processes, and he plans in detail the work of a plant after being supplied with the necessary information concerning the amount of business to be handled. Special attention is given to the theory of cost accounting, and practical exercises in installing and using a cost system are provided. A number of representative printing offices are studied, and critical reports are called for on various aspects of the establishments considered. Throughout the course the student is encouraged to specialize in the subjects to which he wishes to devote himself, and under competent guidance to undertake independent investigations. The results of the student's work in his special field form the subject of a thesis to be prepared in the second half-year.

A laboratory and class-room for the students have been established in the new building of the Harvard University Press, where many of the theories and problems discussed in lectures find practical application under laboratory and shop conditions.

Attention is called to the following course offered by the Faculty of Arts and Sciences: —

FINE ARTS 5e *hf.* The History of the Printed Book. *Half-course. Tu., and (at the pleasure of the instructor) Th., at 3.30.* MR. WINSHIP.

This course is intended for men who are interested in books as objects of art, and who desire to possess or to produce beautiful books. The lectures on the history of printing and its subsidiary crafts will be supplemented by discussions of the characteristic qualities which affect the excellence and the value of any volume. The physical make-up of a book and the conditions governing its manufacture will be explained with sufficient detail to provide a basis for sound judgment of the quality of any piece of work.

The lectures will treat of book production from the period of the illuminated manuscripts to the present time. The work of the men who made noteworthy contributions to the advancement or the deterioration of the art of fine book-making will be studied historically and technically. Considerable attention will be given to the presses which are now producing good work.

The incidental aspects of the subject which affect the collecting of books will be considered. An important object of the course is to train the taste of book-buyers, and to cultivate a well-informed judgment of the value of rare and attractive volumes. The methods by which books of moderate importance are made to seem desirable will be explained. Old and modern examples of good and bad book-making will be shown. There will be opportunities to examine volumes belonging to members of the class and to express opinions as to their fundamental and commercial value.

The class will meet in the Widener Memorial room. The lectures will be illustrated by examples from the Harry Elkins Widener library as well as from the other special collections and the Treasure Room of the Harvard Library. The class will visit the Boston Public and other nearby libraries to examine the literary and bibliographical treasures which they contain. Those men whose subjects for individual study require it may have an opportunity to see some of the private libraries in the neighborhood. In addition to the required reading, each student will be expected to prepare a written report upon the bibliography of some subject of especial interest to him.

Courses Training for Secretaryships of Chambers of Commerce

NEARLY every progressive community in the United States now has an active business men's association. There are over six hundred and fifty of these organizations in the country having more than two hundred members each. Most of these have at least one paid, permanent executive officer, and some have a large staff. These bodies are taking an active part in shaping and working out community plans for growth, and are calling for high grade men as paid executives.

Hitherto these officers have been recruited from various sources — mainly from newspaper work. But as new standards are set by those officers who have grown up with the new conditions, and as the bodies enlarge their scope, there has arisen a demand for men with professional training.

To meet this need a half-course in the first year and a full course in the second year, to be taken in connection with a group of the School's general courses, are devoted to a study of the problems of bodies of this kind.

Chamber of Commerce Work and Methods

Asst. Professor CHERINGTON *and others.* Half-course (second half-year). *Mon., Wed., Fri., at* 11.

Class-room study and discussion of the work of typical American Chambers of Commerce, boards of trade, and similar organizations are supplemented by examination of annual and special reports supplied by the bodies themselves. Organization structure is studied in the same way. A liberal amount of time is given to a study of the powers and limitations of the committee as a working method in chambers of commerce.

Some of the leading secretaries of chambers of commerce in the country come to Cambridge during the progress of the course, to discuss with the class important aspects of the work as they have found it.

Each member of the class is assigned to some nearby organization for practice work. Here he is given a task as an under-secretary and has an opportunity to learn some of the intimate details of the work. The Boston Chamber of Commerce, the Cambridge Board of Trade, the Somerville Board of Trade, the Watertown Board of Trade, Harvard Square Business Men's Association, and the Lynn Chamber of Commerce have provided this form of practice work during the past few years. The University is conveniently located for access to numerous organizations of this kind.

Chamber of Commerce Problems

Asst. Professor CHERINGTON. *Hours to be arranged.*

In the second year, the student who is preparing for a secretarial position in commercial organizations is required to take up some problem, or group of problems, in organization work for investigation in much greater detail than is possible in the preliminary half-course. Research work takes the greater part of the student's time available for this course. Frequent conferences and seminary sessions give an opportunity for reporting results and discussing variations in conditions. During the past year a special feature of this work has been a series of sessions devoted to practice and study in the technique of committee work.

This course is open only to students who have completed satisfactorily Chamber of Commerce Work and Methods.

Attention is called to the following course in Harvard College open to students in this School who are studying to become secretaries of chambers of commerce: —

GOVERNMENT 31. Municipal Administration. *Mon., Wed., Fri., at 11.*
Professor WHIPPLE, Professor MUNRO and others.

This course will deal with the chief problems of municipal administration, with special emphasis on sanitation and public health.

Local Public Utilities

UNTIL recently, the managers of local public service companies were technical men who laid chief stress on the engineering aspects of these companies, paying little attention to the business features of operation. They made possible lower rates through economies in the generating plant and distributing system, neglecting the possibilities of a wider and more saturated market. The heavy investment charge, however, called their attention to the desirability of increasing the output, with the result that costs for different classes of customers were carefully studied and suitable rate schedules introduced. Further economies in operation and lower rates to consumers have resulted.

The two important questions that confront the owners and managers of public utility companies today are profitable increase in the use of their service and friendly relations with the public. The recent rapid birth and growth of regulating bodies has still further emphasized questions of public policy, proper methods of financing, valuation, careful accounting methods, and business-like operation throughout.

Public Utilities Operation (First-year course)

Mr. Blood, *assisted by* Mr. D. L. Stevens, *and the following lecturers:* Messrs. E. W. Bemis, H. G. Bradlee, F. Brown, M. C. Brush, E. W. Burdett, C. E. Claflin, B. F. Cleaves, H. E. Clifford, D. M. DeBard, W. A. Durgin, L. L. Elden, W. W. Freeman, C. E. Fuller, L. D. Gibbs, J. F. Gilchrist, W. Goodnough, W. H. Hodge, J. A. Hunnewell, C. W. Hunter, E. E. Lincoln, J. B. McCall, J. D. Mortimer, L. R. Nash, J. E. Oldham, F. B. H. Paine, R. Robb, H. T. Sands, A. R. Weed, W. F. Wells, N. T. Wilcox. Half-course (second half-year). *Mon., Wed.*, 4.30–6.

In the United States there are over 2,000 gas companies, about 1,200 electric street railways and about 5,200 central electric light and power companies, besides many hundreds of privately owned water supply companies. The purpose of this course is to present the underlying principles of the management and operation of public utilities to men who wish ultimately to fill executive positions in companies of this kind. Previous engineering training is of value but is not a requirement to this course which is open to all students who have satisfactorily completed Factory Management or its equivalent.

The earlier lectures of the course, interspersed by visits to several nearby operating plants and executive offices, deal with the methods of making examinations and of preparing reports. These are followed with class-room discussion of the administrative, business and technical features of the companies examined and of others investigated through annual or special reports. Relative merits of holding companies, of centralized managing associations and of independent operation are considered.

The broadening of the field of operation of public utilities, which brings with it additional responsibilities and demands, together with the methods of meeting them, is covered by lecturers who have achieved success in these lines. Commercial problems and "new business" methods, together with a description of all steps necessary to be performed to "connect up" a new customer, are discussed. Many of the details of management, such as inter-department relations, purchasing, accounting, and collecting, are considered. The value of statistics and their use receive attention. This includes graphic methods of presenting statistics.

The major part of the course, however, is devoted to questions of public policy and to the technical problems of central station management, with emphasis on the importance of securing a high load factor, an understanding of the diversity factor, a study of modern business getting methods, a consideration of the relations with the public and with public authorities. The cause and effect of competition, methods of advertising and various publicity matters are considered. Rate schedules are studied in some detail during the course, and the subject of valuations, how they are made and to what use they should be put, is treated in lectures and in discussions. Public service companies are considered from the business rather than from the engineering standpoint.

At least two business reports are required and these are discussed in class. Throughout the course the student is required to do prescribed reading of current articles, proceedings of commercial associations, and standard works. Monthly examinations, both oral and written, are held for the purpose of developing in the student the ability of expressing what he has learned.

Public Utilities Operation (Second-year course)

Mr. Blood. Half-course (first half-year). *Hours to be arranged.*

In this course each student concentrates his attention on some concrete business problem in public utility management. He is given a choice of a wide range of subjects including specific studies in public relations, internal organization, handling of materials, labor problems, accounting, use of load curves, office methods, and problems of the new business department.

The course is conducted by individual conferences with students. This course may be taken by men who have made a satisfactory record in Public Utilities Operation (first-year course).

[*The Financial Management of Local Public Service Corporations*]

Half-course (second half-year). *Hours to be arranged.*

This course is omitted in 1917–18.

This course is designed for students who expect either to make public utilities their profession, or else to become connected with banking houses which deal in securities of local utility companies. No attempt is made to study the ground-work of corporation finance which is acquired in the course on The Financial Management of Industrial Corporations, but this course assumes a knowledge of these fundamental principles and confines its scope to their application in this special field. Each student is assigned a particular type of utility — gas, steam-electric, hydro-electric, urban or interurban railway, telephone or water company — and in all class discussions is regarded as its representative.

Among the subjects treated in the lectures are franchises, promotions, reorganizations, valuation and leading decisions of courts and commissions. The main work of the course, however, consists in an analysis of the illustrative history of typical public service companies, and the respective merits of different types of financing for companies already in existence. There is considerable class discussion and frequent written reports are required.

Attention is called to the course offered by this School on The Financial Management of Railroad Companies and to the courses listed in the Transportation group in this pamphlet.

Lumbering

FOR men who have had systematic training in the important activities that the lumber business is now being impelled to study — such as marketing and utilization, factory management, scientific cost accounting, and the use of business statistics, the chances for employment and steady advancement are excellent. In the earlier days when timber land was abundant and relatively cheap, lumbering was largely a business of speculation in stumpage, and the rise in the value of the timber often made up the bulk of the profit. Under such conditions the manufacture and distribution of the product did not require the highest efficiency of organization. Meanwhile the supply of timber has become greatly reduced, the business of handling it has become large and complicated, and carrying charges, the costs of labor, materials, and other factors, have gone up rapidly. The result has been that, deprived of the support of cheap stumpage, lumber companies are being compelled to operate on a narrow margin of profit. To secure this profit is more and more plainly a problem of management, of manufacture, including logging and milling, and of distribution, including transportation and selling. Under these circumstances, the problems of wood production, of providing for future supplies of timber, urgent though they are, must still appeal to the capital invested in lumber as secondary to the problem of management.

The realization of this is already widespread, not only among foresters, large numbers of whom have found that it is only in the operating or the business end that they have obtained employment with lumber companies. There are 48,000 sawmills in the United States, not counting many thousand specialized forms of manufacturing which also use wood. The total investment in industries using wood amounts to two and a quarter billion dollars. Chiefly on account of the financial history of timber land ownership and the enormous developments in utilization, these industries are facing the necessity of fundamental readjustments in organization and method. Indeed, the present may be regarded as one of the turning points in the business history of lumbering. Certainly it is recognized by lumbermen as calling for more and more scientific methods within the business and a broader understanding of the economic relations between their own production and that of an ever increasing number of dependent industries. The result is a new opportunity for the man trained in the scientific principles of business as applied to lumbering. This opportunity is to be found not merely in the present desire of lumbermen to employ such men — though that, as in most businesses, is its first indication — but still more in the prospect of ultimate choice among a wide variety of special fields (many of them involving outdoor life) and of having a part in large changes. Besides the openings in established organizations there are opportunities for the man with comparatively small capital to develop a business of his own.

In preparation for the lumbering course, it is found advisable that some preliminary instruction be given the students before the class-room work of the first year begins. Accordingly about August 25 the students are met by the instructor at some point convenient to an up-to-date lumbering operation. About four weeks are spent observing timber, and studying logging and milling operations, after which the students proceed to Cambridge. The exact time and place of meeting may be learned by corresponding with the Dean of the School.

The courses of instruction relating directly to forestry and lumbering are described in the next few pages. Other courses of instruction described in this catalogue give the general foundation essential in all modern business. Accounting Principles, Marketing, and Commercial Contracts are required courses; all others are elective.

During the summer following the first year's work, students are expected to secure employment in a lumber company. This work may be either in connection with a lumbering operation or in the marketing end of the business. The investigative work done in connection with the course in Lumber Problems during the last half of the second year enables the student to specialize in the field in which he expects employment.

Principles of Forestry

Asst. Professors FISHER *and* JACK. Half-course (first half-year).
Tu., Th., Sat., at 11, *and one half-day a week in field work.*

The purpose of this course is to furnish an understanding of the main principles of forestry, both in their relation to the community as a whole, and to the present conduct and future development of the lumber business. The general outline of the course is a summary of the economic and technical elements of forestry. The following topics indicate the ground covered: — the chief species of American trees and their identification; the biological and other natural laws controlling the life of the forest and its influence on its surroundings; and the principles underlying the practice of forestry as an art and a business; the timber supplies of the United States — amount, consumption and growth; relative possibilities and obligations of public and private ownership of forest lands; discussion of concrete examples of applied forestry in typical lumber regions.

Although the survey of so large a field will necessarily be general, certain questions of special interest or direct use to men having to do with timberland ownership will be fully developed. What are the most practicable methods of reproducing forests, and to what extent can they be profitably applied by a business concern ? What, as a matter of established fact, is the effect of forests upon the distribution of surface and ground water, and hence upon stream flow? How does fire affect present and future conditions in the forest, and what are the most effective means of protection against it? What is the nature and comparative soundness of the chief methods of valuing timber and forest growth? What are the actual and possible financial returns from forest property?

The growing of timber as an industry can be established only under favorable economic and business conditions. It is equally certain that the logging and manufacture of timber by lumber concerns cannot endure without the ultimate adoption of more scientific methods of production and utilization. The future of the lumber business and the development of forestry are thus destined to be more and more closely identified.

The field work of the course is conducted both at the Arnold Arboretum and in such tracts of woodland under management as are accessible to Cambridge.

General Lumbering (First-year course)

Asst. Professor GRIES. Half-course (second half-year). *Tu., Th., Sat., at* 9.

The purpose of this course is to acquaint the students with conditions in the lumber industry, to give them some knowledge of the operations and processes involved in logging and the manufacture of lumber, and to acquaint them with problems of management connected with timber resources, logging, and manufacture.

After a brief introductory survey of the present status of the industry, the following points are considered: timber resources: — investments in standing timber, conditions necessitating large timber holdings on the part of the manufacturer, problems involved in the financing of such purchases, carrying charges incident to the ownership of a large supply of raw material, and timber estimating; logging: — the natural and economic factors affecting logging, woods labor, woods operations, transportation of logs, and logging methods in different sections of the United States; manufacturing: — factors affecting the selection of a site, size, and equipment of a saw mill, sawing, grading, handling, seasoning, and finishing of lumber, and the character of reports required by managers of typical saw mill plants.

Through the assignments of subjects for study and report, the students receive an introduction to the character of problems in need of investigation and solution in the present and coming development of the lumber business.

Assistant Professor Bailey is in charge of the work on wood identification. About twelve lectures are devoted to this work and are supplementary to the regular lectures, but are a part of the work in this course.

General Lumbering (Second-year course)

Asst. Professor Gries. Half-course (first half-year). *Tu., Th., Sat., at* 9.

This course follows the course in General Lumbering given in the first year. In preparation, the student spends the summer following the first year's work in the employ of some lumber company. The course is in part a study in the marketing of a single product — lumber.

The work of the course begins with a brief study of the physical properties and uses of wood, and is followed by a discussion of the requirements of consumers or users of wood, such as the building trades, railroads, and certain selected wood-using industries, and of the buying methods of different wood-using concerns.

In the marketing of a product it is of advantage to know not only the physical properties and uses of the product, and the requirements of the consumer, but also the methods of distributors. The chief points to be considered in connection with the distribution of lumber are: — the retail lumber trade: buying, stock handling, selling, and accounting methods, credit policies, and the development of the retail line yard; the wholesale lumber trade: the different types of wholesalers, and the various methods of buying, stock handling, and selling; manufacturing: selling policies, organizations, and the effects of changes in consumers' requirements upon logging and milling.

The concluding lectures are devoted to specific problems of management, and policies considered or adopted in their solution.

Beside the regular class work, students are assigned special problems to be investigated and worked out on the subject of uses of wood, its marketing, and manufacture.

Lumber Problems (Second-year course)

Asst. Professor Gries. Equivalent to full course (second half-year). *Hours to be arranged.*

In this course practical problems connected with the lumber business are assigned to each student for original investigation under the supervision of the instructor in charge. The problems may involve work in the operations of a number of different companies, or they may require that the student's entire time be devoted to one concern. The general character of the problems to be investigated depends upon his previous training and plans for the future.

The problems, as a rule, are such that the student cannot avail himself of a fixed or prescribed method of procedure, but must rely upon his power of analysis and resourcefulness, and upon his knowledge of the lumber business and general business practice. At least one problem assigned to each student requires a careful collection and use of statistics.

Students are freely encouraged and assisted in their research by lumbermen and operators of wood-using plants, and with this help they are able to make investigations of practical value. Frequent conferences with the instructor give an opportunity for reporting results and receiving further instruction; and later, at special sessions, the final report of each student is brought before the class for general discussion.

Bureau of Business Research

Asst. Professor M. F. Copeland, *Director*

THE Bureau of Business Research was established in 1911 by the Graduate School of Business Administration as an agency for gathering information regarding business methods and costs. The Bureau is making a scientific study of business problems as an aid to instruction in the School. Up to the present time it has confined its work entirely to marketing, a large field in which there has hitherto been little scientific investigation.

The retail shoe business was the first to be studied. That business was selected because it is concerned with a fairly homogeneous group of articles and because, at the same time, it illustrates various methods of retailing — the specialty store, department store, chain store, manufacturer's retail branch, and mail order house. In June, 1914, the Bureau began a similar study of the retail grocery trade, a business which is more diversified and illustrates other principles and methods of retail distribution. In July, 1916, a study of the wholesale shoe trade was commenced and in November, 1916, a study of the wholesale grocery trade.

In each of its investigations the Bureau has followed the same plan. Because of variations in bookkeeping methods and the absence of any similarity in definitions of terms, the Bureau has found it necessary in each case to prepare a uniform accounting system as a means for securing comparable figures. Four uniform accounting systems have been published. The two retail systems are very similar and the two wholesale systems also closely resemble each other. These accounting systems are being more and more widely adopted in the businesses for which they have been prepared. This, of course, makes it easier for the Bureau to secure reliable figures and at the same time enables the users of the systems to compare their own results more intelligently with the Bureau's summaries.

Upon these accounting systems as bases the Bureau collects figures on operating expenses in these businesses. Information regarding the best trade practice is also being gathered. The Bureau has received, up to March, 1917, confidential information from over 1,000 shoe retailers, from over 1,100 retail grocery stores, from over 100 wholesale grocers, and from a smaller number of shoe wholesalers. In its bulletins it has published, in addition to the accounting systems, summaries of operating expenses in the retail shoe business and in the retail grocery business, and also a standard stockkeeping system for retail shoe stores. The work of the Bureau is proving to be of value not only to the School but also to a steadily increasing number of business men.

Library Facilities

THE Special Library of the School comprises a collection of about 3500 books and as many pamphlets relating to business organization and administration. Its larger collections on railroad organization and operation, accounting, and scientific management are supplemented by rapidly growing collections on marketing (including advertising and store management), banking, insurance, foreign and domestic trade methods, printing and publishing, public utilities, and corporation management and finance. A comprehensive collection of the latest books on each subject considered in the School is permanently available.

In addition to the collection of books and pamphlets, a file of the financial reports of the principal industrial and public utility corporations of the country is maintained. Two hundred and twenty-five trade and business periodicals, including several from South America and Europe, are on file currently. The Library possesses a complete file of several of these periodicals, as the "Iron Age," the "Commercial and Financial Chronicle," "System," "Printers' Ink," and the "Engineering and Mining Journal," and many other trade papers invaluable to those pursuing special research work.

A special effort has been made to gather together and preserve original unpublished manuscript material relating to current events in the industrial world.

The Library is located in Rooms H and I on the third floor of the new Widener Library Building, where adequate quarters have been secured and special accommodations are provided for students pursuing advanced work. Special privileges, including direct access to the stacks containing the extensive collections of Harvard College Library, and opportunity to consult the highly specialized collections of the departmental libraries of the University, will be granted to students engaged in research work.

A special librarian is in charge of the Library of the School and is personally ready to assist students in their search for material. The rooms are open daily except Saturday and Sunday from 9 A.M. until 10 P.M.; on Saturdays the rooms close at 1 P.M.

The Library of the University contains over 1,000,000 bound volumes and 700,000 pamphlets. It includes more than 24,000 volumes relating to Economics and an extensive collection of government documents, trade and labor periodicals, and railroad reports. The exceptionally comprehensive library of the Harvard Law School, numbering over 160,000 volumes, is also available.

In Boston, the Public Library, second in size in the United States, contains a valuable statistical collection. Students of the School are granted admission to the Massachusetts State Library and to the library of the Insurance Library Association of Boston, the most complete of its kind in the United States, as well as privileges at some of the special libraries formed by Boston business houses.

Positions

Term-Time Positions

THERE are numerous ways to earn money during attendance at the University. The Student Employment Office, 9 University Hall, Cambridge, secured 1000 positions yielding $39,506.32 from September 27, 1915, to June 22, 1916; and it is probable that these figures would have been doubled if all Harvard students had reported work secured independent of this bureau. Prospective students are, however, urged not to depend too much upon securing financial assistance from outside employment while pursuing the regular work of this School. Experience has shown that the best results are secured when a student is able to give his nearly undivided attention to his graduate course of study.

Summer Positions

The School expects that all first-year students planning to return for the second year's work, in the absence of unusual circumstances, will work during the intervening summer vacation, wherever possible, in the branch of business for which they are preparing themselves in the School. The practical experience thus gained is valuable for several reasons: students may thus serve before their graduation a portion of the inevitable and essential period of apprenticeship; they obtain that contact with men at work which is so valuable a portion of education and which is so essential in developing managing ability; moreover, through experience in the conditions in their profession, they may possibly choose more definitely the direction of their specialized work during the second year.

The summer's pay is usually sufficient to cover bare living expenses. Leading business men in various lines have expressed their willingness to give summer employment to students of the School and to coöperate with the School by returning at the end of the period of employment a report on the work of the student. A permanent record of these reports is filed with the marks received in the School, and is an important consideration in recommending students for a permanent position upon graduation.

Permanent Positions

Former students of the School are found in a wide variety of businesses. According to a canvass made by the Business School Alumni Association during 1915, manufacturing is clearly the most popular pursuit, appealing to more men than any other two fields. Accounting and statistics, banking and brokerage, and real estate and insurance are close together in representation, each with approximately one-half the number of men that take up manufacturing. Other callings with a considerable representation are: railroading, advertising and selling, "efficiency engineering," teaching, statistical work, local utilities, law, foreign trade, printing and publishing, chamber of commerce work, and lumbering. The starting compensation for graduates usually ranges from $600 to $1600 per annum.

Graduates of the School will understand that on entering actual business life they will usually begin at the bottom and must submit willingly to the drudgery and discipline of routine work. This mastery of detail is an essential part of the training and cannot be gained except by such experience, but the apprenticeship may be shortened and made more valuable by applying the knowledge of principles systematically studied in the School.

The School cannot guarantee positions. Our experience has been, however, that on account of the demand among business men for our Business School graduates satisfactory openings for those who have made a good record here usually may be obtained without difficulty through the recommendation of the School.

Bond Requirements

Payments

EVERY resident student must file with the Bursar a bond in the sum of *two hundred dollars,* signed by two bondsmen, one of whom must be a citizen of the United States, or by a surety company duly qualified to do business in Massachusetts, as security for the payment of University bills; or he may deposit with the Bursar two hundred dollars in United States bonds for the same purpose; or he may deposit *fifty dollars* as security and pay in advance all sums for which he shall become liable to the University. Money deposited as security is returnable after the issue of the second term-bill, one week before Commencement.

If, however, he occupies a College room or boards at Memorial Hall or at Foxcroft Hall he must file a bond for *four hundred dollars,* or must in advance, and in addition to his tuition fees, pay the full year's rent of his room, and make a deposit as security for the payment of his board at the rate of *five and a half dollars a week.*

No officer or student of the University is accepted as a bondsman.

Blank forms of bonds may be obtained on application to the Bursar, Dane Hall, Cambridge, or to the Dean of the Graduate School of Business Administration.

Fees

Tuition Fees

THE tuition fee charged to new students is $200; and no Stillman Infirmary, laboratory, or graduation fee is charged to students paying a tuition fee of $200 or more.

Students in the Graduate School of Business Administration not doing full work are required to pay fees for the courses which they take, instead of paying the full tuition fee of a student in regular standing, and are not allowed to visit classes without the consent of the Dean and the instructor in charge and without paying the regular fees for the courses so visited. But a student paying less than the regular tuition fee is not allowed to be the holder of a fellowship or scholarship, or to count the year as a full year of study for a degree.

The fees for single courses are fifty dollars for a full course, and twenty-five dollars for a half-course.

No deduction for absence or withdrawal is made from the fees for single courses. A student who attends a course of instruction for only a part of the year must pay the whole fee for such course. But a student who is liable for the full tuition fee is entitled to the same remission as a student in regular standing.

Stillman Infirmary

Every student paying the full tuition fee of two hundred dollars a year is entitled, in case of sickness and on the order of a physician, to a bed in a ward, board. and ordinary nursing at the Infirmary for not exceeding two weeks in any one academic year. Charges are made for time in excess of two weeks, as well as for private rooms and for special nursing; and the patient pays his physician.

Students paying less than the full tuition fee of two hundred dollars are charged for full time if they use the Infirmary unless before October 1st they have paid to the Bursar a special fee of four dollars; in which event they are given the privileges of those who pay full tuition.

The fee of four dollars is *required* of all students registered in the school prior to 1916–17 unless they pay a tuition fee of two hundred dollars or are entitled to exemption under the rules then in force.

Graduation Fee

A graduation fee of twenty dollars is charged to each student taking a degree in the School unless he has paid a tuition fee amounting to two hundred dollars.

Term-Bills — Payment of the Tuition Fee

All students are required to pay the tuition fee in advance. Students doing full work pay fifty dollars on or before the opening day of the academic year, fifty dollars on or before November 23, fifty dollars on or before February 11, and, in case their full fee is two hundred dollars, a fourth instalment of fifty dollars on or before April 22. Students entitled to the old rates of tuition pay the Infirmary fee as heretofore with the first instalment of the tuition fee.

Students doing less than full work and paying at the course rate, pay in the same manner as those who are doing full work, until all their work has been paid for.

A student who is doing less than full work is required to present at the Bursar's office, at the beginning of the academic year, a certificate from the Dean or the Secretary of the School, stating the courses that he is taking; and he is not permitted to attend courses that are not included in the certificate.

No bills are sent specifically for the tuition fee; although the third instalment is incorporated for convenience with the first term-bill, since they fall due on the same day.

The first term-bill is issued January 20, and must be paid on or before February 10. This bill includes, in addition to the third instalment of the tuition-fee, such charges as the following: Two-thirds of the year's charges for the use of a College room; fees for laboratory courses which begin in the first half-year; locker fees; such incidental charges as can then be determined; charges for gas and electricity, and for board at the Dining Halls, made up to as late a date as practicable.

The second term-bill is issued one week before Commencement, and contains charges not included in the first bill. The second term-bill must be paid by all candidates for degrees at least one day before Commencement; and, by all other students, on or before July 20.

When a student's connection with the University is severed, all charges against him must be paid at once.

Each student whose dues to the University remain unpaid on the day fixed for their payment is required at once to cease attending lectures or recitations, using the libraries, laboratories, gymnasium, athletic grounds or buildings, boarding at the Harvard Dining Association or at the Foxcroft Hall Association, and making use of any other privileges as a student, until his financial relations with the University are satisfactory to the Bursar. Failure to comply with this rule is deemed cause for final separation of the student from the University.

Prizes

MR. GEORGE OLIVER MAY offers two annual prizes of one hundred dollars and fifty dollars, respectively, for the best two graduation theses. Particulars concerning graduation theses are to be found in the statement describing requirements for the degree, on page 00.

Mr. Harry Hodgson offers a prize of twenty-five dollars for the best essay by a first-year or second-year student on (1) "The Value of Fertilizers in increasing Crop Production" or (2) on "The Marketing of Cotton Seed Products." Theses prepared as part of the regular work in any of the courses in the School are eligible for this prize. Competitors must submit their theses to the Dean on or before April 25.

Student Aids

Loan Fund

THE five University Scholarships of two hundred dollars each, formerly open to students in the School, have been abolished and an equivalent amount was appropriated for several years for the benefit of the loan fund in the School. This cumulative fund was established through the generosity of friends of the School for the benefit of students who are in need of pecuniary assistance. As a rule, only second-year students of promise can hope to receive assistance from this source, although a limited amount is sometimes available for first-year students of high standing.

Fellowships and Scholarships

The following are among the Fellowships and Scholarships available in other Departments of the University as well as in the Graduate School of Business Administration: —

THE DANIEL A. BUCKLEY SCHOLARSHIPS; fifty in number, with an income of one hundred and fifty dollars each, for graduates of Cambridge public schools

THE SCHOLARSHIP OF THE HARVARD CLUB OF CHICAGO; with an income of three hundred dollars. Maintained by the Harvard Club of Chicago; . . . to be awarded to a graduate of an Illinois university or college who wishes to pursue graduate studies at Harvard University . . . to be appointed by a committee of the Club.

THE SCHOLARSHIP OF THE HARVARD CLUB OF HAWAII; with an income of two hundred dollars. This scholarship was founded in 1908, to be awarded " to a deserving student in any department of Harvard University, nominated by the Harvard Club of Hawaii subject to the approval of the Committee on Scholarships and Other Aids for Undergraduates of Harvard University. It is proposed to maintain the scholarship by annual contribution; the award to be made with the understanding that it is a loan, repayable after a term of years."

THE SCHOLARSHIP OF THE HARVARD CLUB OF LOUISIANA; with an income of about two hundred and fifty dollars. Maintained for the present by the HARVARD CLUB OF LOUISIANA; to be awarded to a graduate of Tulane University who wishes to pursue advanced non-professional studies at

Harvard University. The appointment is made by the President and Faculty of Tulane University.

THE WILLIAM STANISLAUS MURPHY SCHOLARSHIPS; two hundred and fifty dollars each. These scholarships, founded by William Stanislaus Murphy of the Class of 1885, are to be used for the collegiate education of men of the name of Murphy, who, in the judgment of the Faculty, prove deserving of this kind of encouragement. These scholarships are available for students in any department of the University.

THE SCHOLARSHIP OF THE HARVARD CLUB OF NEBRASKA; with an income of one hundred and fifty dollars, open to a graduate of a Nebraska high school, or Nebraska college or university, during his first year of residence.

THE CHARLES ELLIOTT PERKINS SCHOLARSHIP; with an income of three hundred dollars, " to be offered each year to a graduate of an Iowa college or university in any of the graduate or professional departments of Harvard University."

THE PRINCETON FELLOWSHIP; with a stipend of four hundred and fifty dollars. From a graduate of Princeton University, to be awarded to a graduate of that University studying in any department of Harvard University.

THE SCHOLARSHIP OF THE ROCKY MOUNTAIN HARVARD CLUB. Maintained since 1890 by the Rocky Mountain Harvard Club, of Denver, Colorado; to be awarded to a promising graduate of a Colorado college or school pursuing his studies at Harvard University; the appointment to be made annually by a committee of the Club.

THE JAMES A. RUMRILL GRADUATE SCHOLARSHIP; with an income of two hundred and twenty-five dollars. This scholarship, established in memory of JAMES AUGUSTUS RUMRILL, of Springfield, Mass., a member of the Class of 1859, will be offered each year to a properly qualified graduate of a college or university in Virginia, North Carolina, South Carolina, Florida, Georgia, Tennessee, or Kentucky, who desires to pursue his studies in one of the graduate departments of Harvard University.

THE EDWARD RUSSELL SCHOLARSHIP; with an income of two hundred and seventy-five dollars. This scholarship may be awarded to a student in a graduate department of the University. It may be divided at the discretion of the Scholarship Committee.

THE FREDERICK SHELDON FUND FOR TRAVELLING FELLOWSHIPS AND SCHOLARSHIPS. The income of this Fund is available for holders of any degree from Harvard University. For further particulars, see University Catalogue for 1916–17, page 641.

THE SCHOLARSHIP OF THE HARVARD CLUB OF UTAH; with an income of three hundred dollars. This scholarship will probably, like many other state scholarships, go to undergraduates; it may be competed for, however, by graduate students in the Business School.

Students' Expenses

THE necessary expenses of tuition and residence include tuition ($200), room ($50 to $200), and board ($125 to $225). In addition to these charges for which every one must plan, a student's expenses will include charges which vary with the means and habits of the individual — as, for example, furniture, books and stationery, clothing, fuel, laboratory charges, membership in societies, subscriptions, service, and the expenses of vacations. To help students in reducing their expenses, a number of coöperative institutions are established in connection with the University, such as the dining halls, the Loan Furniture Association, the Text-book Loan Library, and the Harvard Coöperative Society. Information as to the cost of living and the various aids which the University affords to students may be obtained in a pamphlet entitled " Students' Expenses and College Aids," which will be sent to any one without charge on application to the Publication Office, 2 University Hall.

The University has two dining halls conducted at cost for the benefit of their members. Memorial Hall provides board at a fixed price per week and Foxcroft Hall board on the *à la carte* plan.

The price of board at Memorial Hall was fixed for the year (1916–17) at $5.50, which was sufficient to insure an ample and varied fare. In addition to the food served on the regular bill of fare, a large extra order list is maintained from which articles may be specially ordered. The charges for board are made on the College term-bills. A small membership fee is charged.

Application for admission may be made by any member of the University, or by any one intending to enter the University. Friends may secure seats together by forming a "Club Table." Adjoining tables are reserved for members of the School. Application for membership should be made before September 15 to secure a chance in the first allotment of seats for the following Academic year. The Hall opens on registration day. Application blanks and further information may be obtained from the Auditor, Memorial Hall, Cambridge.

Membership in Foxcroft Hall is open to any member of the University. The cost of board varies with the needs of individuals, but $4.25 is ordinarily to be regarded as the minimum cost of substantial fare. The charges for board are made on the College term-bills. A small membership fee is charged. Application for admission should be made early to the Auditor, Foxcroft Hall, Cambridge.

For information about college rooms address the Bursar, Dane Hall, Cambridge.

Students 1916-17

Graduate Student

Stevens, Don Lorenzo, S.B. (*Case School of Applied Science*) 1914,	*Cleveland, O.*	C't 13

Second Year

Bates, Clement Taggart, A.B. 1916,	*Cambridge,*	4 Forest St.
Bird, Florian John, A.B. 1915,	*Milwaukee, Wis.*	W. H. 6
Bonsall, George Hubert, Jr., A.B. (*Princeton Univ.*) 1915,	*Haverstraw, N. Y.*	120 Mt. Auburn St.
Boyle, Lewis Vincell, Jr., A.B. (*Leland Stanford Jr. Univ.*) 1909, A.M. (*ibid.*) 1910,	*Sacramento, Cal.*	106 Ellery St.
Brown, William Clark, Jr., A.B. (*Arkansas Coll.*) 1915,	*Hot Springs, Ark.*	P. 55
Bruce, Starr Lewis, A.B. (*Leland Stanford Jr. Univ.*) 1915,	*San Francisco, Cal.*	W. H. 35
Burton, Norman Lee, A.B. (*Williams Coll.*) 1911,	*Oak Park, Ill.*	65 Dana St.
Camp, Jay Beidler, A.B. 1915,	*Chicago, Ill.*	W. H. 56
Chaffee, Frank Everett, A.B. (*Leland Stanford Jr. Univ.*) 1915,	*Pasadena, Cal.*	1010 Mass. Ave.
Clark, Norman Balch, A.B. 1916,	*Newtonville,*	205 Crafts St., Newtonville
Crockett, Gilman Kimball, S.B. (*Pennsylvania State Coll.*) 1915,	*Wareham,*	19 Ware St.
Folsom-Jones, Otto Rockefeller, A.B. (*Bowdoin Coll.*) 1915,	*Skowhegan, Me.*	53 Oxford St.
Friedman, Henry Eli, A.B. 1916,	*Medford,*	W. 54
Greeley, Thornton, A.B. 1913,	*Butler, Pa.*	1750 Cambridge St.
Green, James Arthur, A.B. (*Acadia Univ.*) 1915,	*St. John, N. B.*	18 Mellen St.
Habberstad, Earle Sylvanus, A.B. (*Beloit Coll.*) 1915,	*Lanesboro, Minn.*	7 Sumner R'd
Hallstead, William Finn, 2d, A.B. (*Princeton Univ.*) 1915,	*Scranton, Pa.*	40 Brattle St.
Harding, George Laban, A.B. (*Indiana Univ.*) 1915,	*Indianapolis, Ind.*	H'ke 27

Horan, James Francis, A.B. (*Catholic Univ. of America*) 1913,	*So. Manchester, Conn.*	8 Centre St.
Hoyt, Harrison Val, S.B. (*Purdue Univ.*) 1913,	*Nephi, Utah,*	885 Mass. Ave.
Jackson, Philip Ludwell, LITT.B. (*Princeton Univ.*) 1915,	*Portland, Ore.*	W. H. 1
Jamieson, Hugh John, A.B. (*Univ. of Wisconsin*) 1915,	*Poynette, Wis.*	Craigie 207
Jay, Gilbert DeLafayette, Jr., A.B. (*Wabash Coll.*) 1915,	*Kokomo, Ind.*	36 Ash St.
Keene, Alden Vinal, A.B. 1916,	*Watertown,*	40 Fayette St., Watertown
Lau, Paak Tong, S.B. (*Univ. of Pennsylvania*) 1915,	*Canton, China,*	18 Mellen St.
Lerew, John William, A.B. (*Lebanon Valley Coll.*) 1915,	*Dillsburg, Pa.*	58 Hammond St.
Levine, Charles Hochzeit, S.B. (*Carnegie Institute of Technology*) 1915,	*New Castle, Pa.*	118 Trowbridge St.
Lincoln, Irving Boin, S.B. (*Mass. Agricultural Coll.*) 1915,	*Glens Falls, N. Y.*	P. 28
Loveman, Adolph Maurice, A.B. (*Yale Univ.*) 1915,	*Nashville, Tenn.*	1727 Cambridge St.
McGarry, Edmund Daniels, A.B. (*West Virginia Univ.*) 1914,	*Shenandoah Junction, W. Va.*	42 Kirkland St.
McWilliams, George Arthur, A.B. (*Bowdoin Coll.*) 1915,	*Bangor, Me.*	P. 57
Marshall, Howard Parsons, A.B (*Univ. of Wisconsin*) 1915,	*Milwaukee, Wis.*	42 Kirkland St.
Mills, Dudley Holbrook, A.B. (*Princeton Univ.*) 1915,	*New York, N. Y.*	83 Brattle St.
Moore, Charles Hiram, A.B. 1913,	*Springfield,*	20 Ellery St.
Neff, Arthur Guy, A.B. (*Oberlin Coll.*) 1914,	*Cleveland, O.*	P. 28
Postlethwait, Archie Goodrich, A.B. (*Pomona Coll.*) 1915,	*Corry, Pa.*	Ridgely 21
Putnam, Willard Samuel, A.B. 1916,	*Cambridge,*	9 Dana St.
Redmond, Frank Albert, A.B. (*Washburn Coll.*) 1912, LL.B. (*ibid.*) 1915,	*Topeka, Kan.*	21 Wendell St.
Reed, Alden, S.B. (*Worcester Polytechnic Institute*) 1915,	*Worcester,*	106 Woodland St., Worcester
Ricketts, William Brown, A.B. (*Washington and Jefferson Coll.*) 1914,	*Slippery Rock, Pa.*	120 Mt. Auburn St.
Roth, Ernest Charles, A.B. (*Univ. of Michigan*) 1915,	*Peru, Ill.*	P. 29

Rundell, Edward Coghlin, A.B. (*St. John's Univ., O.*) 1914,	*Toledo, O.*	W. H. 6
Sargent, Homer Aaron, A.B. 1915,	*Winter Hill,*	Dana 23
Spoor, E. Herbert, A.B. (*Pomona Coll.*) 1915,	*Redlands, Cal.*	Ridgely 21
Story, Richard Wetmore, A.B. 1915,	*Essex,*	Winthrop St., Essex
Swan, John, A.B. 1912,	*Brooklyn, N. Y.*	475 Broadway
Viosca, James Blaydes, A.B. (*Arkansas Coll.*) 1915,	*Hot Springs, Ark.*	P. 55
Weathers, Paul Dyess, A.B. (*Amherst Coll.*) 1915,	*Ocala, Fla.*	Winthrop 28
Welshons, Gordon Carlisle, A.B. (*Carleton Coll.*) 1915,	*Stillwater, Minn.*	2 Gorham St.
Willard, Albert Robinson, S.B. (*Colby Coll.*) 1915,	*Fayville,*	Fayville

First Year

Aiton, Franklin Peveril,*	*Stoneham,*	32 Gould St., Stoneham
Anderson, William Boone, A.B. (*Univ. of Texas*) 1916,	*Lancaster, Tex.*	1254 Commonwealth Ave., Boston
Armstrong, James Syng, LITT.B. (*Princeton Univ.*) 1916,	*Middletown, Conn.*	42 Kirkland St.
Austin, Joel Dibble, A.B. 1916,	*Milton,*	Gnt. 3
Beal, Gerald Fessenden, A.B. 1916,	*Hanover,*	Fairfax 26
Beckel, Raymond St. Clair, A.B. (*Miami Univ.*) 1916,	*Washington Court House, O.*	30 Copley St.
Blattner, George Wayman, A.B. (*Univ. of Texas*) 1915,	*Sulphur, Okla.*	Craigie 207
Bleecker, Robert Boynton, A.B. (*Leland Stanford Jr. Univ.*) 1916,	*Pasadena, Cal.*	Craigie 506
Brown, William Thayer, PH.B. (*Yale Univ.*) 1916,	*East Orange, N. J.*	Winthrop 22
Bullen, Walter Boardman, A.B. (*Brown Univ.*) 1899, A.M. (*ibid.*) 1903, B.D. (*Newton Theol. Institute*) 1904,	*Newton Centre,*	2 Ripley Terrace, Newton Centre
Burbans, Nathaniel Charles, S.B. (*Iowa State Coll.*) 1916,	*Burlington, Ia.*	52 Irving St.
Cadle, Chester Junius, A.B. (*Univ. of Illinois*) 1916,	*Charleston, Ill.*	44 Brattle St.

---

* Has completed work in Harvard College for the Bachelor's degree.

Capron, Wilbur Wintersmith, A.B. (*Syracuse Univ.*) 1916,	*Wayland, N. Y.*	69 Oxford St.
Carroll, Charles Schofield, A.B. (*Holy Cross Coll.*) 1908, A.M. (*Clark Univ.*) 1909,	*Worcester,*	16 Trowbridge St.
Chace, John Derrol, A.B. (*Leland Stanford Jr. Univ.*) 1915,	*San Jose, Cal.*	52 Irving St.
Chandler, Hazen Atherton, A.B. (*Amherst Coll.*) 1916,	*Montpelier, Vt.*	5 Linden St.
Chapman, William Ray, A.B. (*West Virginia Wesleyan Univ.*) 1915, A.M. (*ibid.*) 1916,	*Buckhannon, W. Va.*	326 Harvard St.
Charde, Newell, S.B. (*Univ. of Colorado*) 1915,	*Burlington, Colo.*	94 Prescott St.
Cheney, Charles Ward, A.B. 1915,	*Peterboro, N. H.*	Randolph 13
Chow, Chi Pang, A.B. (*St. John's Univ.*) 1913, S.B. (*Univ. of Pennsylvania*) 1916,	*Ningpo, China,*	43 Irving St.
Chow, Tsi-Ki, B.C.S. (*New York Univ.*) 1916,	*Peking, China,*	12 Summer St.
Coburn, Augustus, Jr., A.B. (*Wabash Coll.*) 1916,	*Indianapolis, Ind.*	36 Ash St.
Cogswell, Franklin, A.B. (*Pomona Coll.*) 1916,	*Pomona, Cal.*	Hollis 7
Cohen, William, S.B. 1915, A.M. 1916,	*Boston,*	18 Poplar St., Boston
Colton, Edwin Miller, A.B. (*Ohio Wesleyan Univ.*) 1916,	*Bellefontaine, O.*	11 Mellen St.
Condon, Guy Berwyn, A.B. (*Univ. of Maine*) 1916,	*So. Penobscot, Me.*	40 Kirkland St.
Craig, Maynard, A.B. (*Ohio Wesleyan Univ.*) 1916,	*Washington Court House, O.*	11 Mellen St.
Cudd, Robert Leonard, A.B. (*Wofford Coll.*) 1916,	*Spartanburg, S. C.*	15 Sumner R'd
Cunningham, Robert Larmour, A.B. (*Olivet Coll.*) 1916,	*Marshall, Mich.*	54 Garden St.
Davidson, Lawrence Loeb, S.B. (*Dartmouth Coll.*) 1916,	*Sioux City, Ia.*	Westmorly 24
Dildine, Paul LeRoy, A.B. (*Miami Univ.*) 1914,	*New Waterford, O.*	16 Trowbridge St.
Donnan, Edmund Arthur, A.B. (*Washington and Jefferson Coll.*) 1916,	*Washington, Pa.*	Craigie 206

Donovan, Patrick Joseph, A.B. (*Boston Coll.*) 1916,	*Roxbury,*	11 Leon St., Rox.
Durkin, Emmet James, A.B. (*Univ. of California*) 1916,	*Spokane, Wash.*	54 Dunster St.
Edmiston, Francis Marion, A.B. (*Ohio State Univ.*) 1916,	*Columbus, O.*	40 Kirkland St.
Elliott, Douglas Alexander, LITT.B. (*Princeton Univ.*) 1915,	*Brookline,*	143 Freeman St., B'kline
Emison, Richard Allen, A.B. (*DePauw Univ.*) 1916,	*Vincennes, Ind.*	30 Langdon St.
Enright, William Fairleigh, A.B. 1916,	*St. Joseph, Mo.*	Westmorly 4
Ewers, Herman D., A.B. (*Washburn Coll.*) 1916,	*Independence, Kan.*	161 Hancock St.
Flynn, Harold Francis, A.B. (*Holy Cross Coll.*) 1916,	*Woonsocket, R. I.*	1734 Cambridge St.
Folks, Ray Jessee, A.B. (*Kansas State Univ.*) 1915,	*Campbell, Mo.*	1727 Cambridge St.
Forney, Louis Gerisch, LITT.B. (*Princeton Univ.*) 1916,	*Cleveland, O.*	4 Story St.
Foster, Dwight, A.B. 1916,	*Milton,*	Ridgely 4
Fowler, Herbert Carey, A.B. (*Williams Coll.*) 1916,	*East Orange, N. J.*	1727 Cambridge St.
Fung, Henry Kien-Tung, A.B. (*St. John's Univ.*), 1913; A.M. (*Princeton Univ.*) 1915,	*Canton, China,*	64 Astor St., Boston
Garver, Philip Albert, A.B. (*Otterbein Univ.*) 1915,	*Strasburg, O.*	1746 Cambridge St.
Garvey, John Joseph, A.B. (*Boston Coll.*) 1916,	*Cambridge,*	445 Main St.
Gendron, Courtenay Holbrook, A.B. 1916,	*Winchester,*	22 Calumet R'd, Winchester
Gerish, Edward Frederick, A.B. (*Ohio State Univ.*) 1915, A.M. (*ibid.*) 1916,	*Columbus, O.*	2 Decatur St., Boston
Glaze, John William, A.B. (*Trinity Coll.*) 1916,	*Raleigh, N. C.*	47 Wendell St.
Ham, Fred Lemuel, A.B. 1915,	*Cambridge,*	27 Ellery St.
Hamilton, Lloyd Andrews, A.B. (*Syracuse Univ.*) 1916,	*Pittsfield,*	69 Oxford St.
Hawley, Allen Franklin, A.B. (*Pomona Coll.*) 1916,	*San Diego, Cal.*	P. 31
Head, Alden Fairfield, A.B. (*Bowdoin Coll.*) 1916,	*Bangor, Me.*	P. 57
Hollen, Edwin Stanley, A.B. (*Univ. of Wisconsin*) 1915,	*Eau Claire, Wis.*	Dunster 22

Horst, Amos Long, A.B. (*Univ. of Pennsylvania*) 1915,	*Lebanon, Pa.*	Drayton 21
Horton, Winter, A.B. (*Univ. of Pennsylvania*) 1915,	*Brooklyn, N. Y.*	68 Oxford St.
Hughes, Gerard Hastings, A.B. 1916,	*Ossipee, N. H.*	M. 42
Hughes, John David, A.B. (*Holy Cross Coll.*) 1915,	*Worcester,*	124 Endicott St., Worcester
Hull, Howard Brainard, A.B. 1916,	*Bridgeport, Conn.*	P. 38
Hunt, Raymond Sailors, S.B. (*Northwestern Univ.*) 1916,	*Kokomo, Ind.*	36 Ash St.
Hunt, William Parmenter, A.B. 1916,	*Cambridge,*	16 Lancaster St.
Johnson, Wallace Bradley, PH.B. (*Hamilton Coll.*) 1915,	*New York, N. Y.*	Winthrop 12
Jones, Thomas Roy, S.B. (*Univ. of Kansas*) 1913,	*Arkansas City, Kan.*	1727 Cambridge St.
Kennedy, William Dorsey, A.B. (*Williams Coll.*) 1916,	*Cleveland, O.*	84 Prescott St.
Krauss, William Carl, S.B. (*Carthage Coll.*) 1916,	*Jonesboro, Ill.*	52 Plympton St.
Kreimer, Erwin Henry, A.B. 1916,	*Cincinnati, O.*	2 Holyoke St.
Lackey, William Edward, A.B. (*Univ. of Oregon*) 1915,	*Eugene, Ore.*	96 Prescott St.
Lambeth, John Walter, Jr., A.B. (*Trinity Coll.*) 1916,	*Thomasville, N. C.*	47 Wendell St.
Levin, Abraham Simeon,*	*Terre Haute, Ind.*	12 Holyoke Pl.
Libby, Malcolm Mark, S.B. in M.E. (*Worcester Polytechnic Inst.*) 1900; S.B. in E.E. 1903,	*Edmonton, Alberta, Can.*	G. 49
Little, Arthur Perry, A.B. 1916,	*St. Johnsbury, Vt.*	D. 11
Lothrop, Thomas Addison, A.B. 1916,	*Cohasset,*	Ridgely 34
Loucks, Elton Crocker, A.B. (*Univ. of Oregon*) 1915,	*Portland, Ore.*	3 Sumner R'd
Love, James Spencer,*	*Cambridge,*	16 Hilliard St.
McCann, William Webster, A.B. (*Bates Coll.*) 1916,	*Mechanic Falls, Me.*	66 Kirkland St.
McClamroch, John Charles, A.B. (*Wabash Coll.*) 1916,	*Frankfort, Ind.*	36 Ash St.
McCorkle, Walter Jefferson, A.B. (*Park Coll.*) 1915,	*Dallas, Tex.*	8 Pine St., Boston
MacKinnon, Neil Laughlin, A.B. (*Boston Univ.*) 1916,	*Boston,*	128 W. Brookline St., Boston

---

* Has completed work in Harvard College for the Bachelor's degree.

McLain, Frederick French, A.B. (*Occidental Coll.*) 1916,	*Pasadena, Cal.*	67 Hammond St.
McMichael, David McDill, A.B. (*Monmouth Coll.*) 1916,	*Monmouth, Ill.*	841 Wendell St.
Malone, Wallace Davis, A.B. (*Univ. of Alabama*) 1916,	*Dothan, Ala.*	44 Brattle St.
Mann, Lawrence Bacon, A.B. 1915,	*Malden,*	64 Frost St.
Mendes, Reginald Gordon, A.B. (*Fordham Univ.*) 1915,	*New York, N. Y.*	1750 Cambridge St.
Mickey, William Earle, A.B. (*Lebanon Valley Coll.*) 1916	*Harrisburg, Pa.*	58 Hammond St.
Morrison, Alexander, S.B. (*Dartmouth Coll.*) 1916,	*Lynn,*	3 Grosvenor P'k, Lynn
Mudge, James Wiswell, A.B. (*Wesleyan Univ.*) 1902; LL.B. (*Harvard Univ.*) 1907,	*Melrose,*	Wyoming Heights, Melrose
Murphy, James Benjamin, A.B. (*Holy Cross Coll.*) 1916,	*Chicopee,*	1750 Cambridge St.
Park, Robert Hodges, A.B. (*Amherst Coll.*) 1916,	*Taunton,*	29 Prospect St., Taunton
Patterson, Jefferson, A.B. (*Yale Univ.*) 1913; LL.B. (*Harvard Univ.*) 1916,	*Dayton, O.*	Winthrop 9
Peterson, Frank Seth, A.B. (*Boston Univ.*) 1916,	*Woods Hole,*	75 Westland Ave., Boston
Peterson, George Baltzer, A.B. (*Univ. of California*) 1916,	*Belvedere, Cal.*	W. H. 35
Pinkham, Willard Bartlett, S.B. (*Mass. Inst. of Technology*) 1915,	*Roxbury,*	33 Wabon St., Rox.
Potter, George Leonard, PH.B. (*Hamilton Coll.*) 1915,	*Lafayette, Ind.*	Winthrop 21
Preble, Theodore Lunt, A.B. (*Univ. of California*) 1916,	*Berkeley, Cal.*	42 Wendell St.
Reichmuth, Erwin Ferdinand, A.B. (*Ripon Coll.*) 1916,	*Ripon, Wis.*	42 Kirkland St.
Reynolds, Francis Anthony, A.B. (*Boston Coll.*) 1916,	*Roxbury,*	12 Sunnyside St., Rox.
Richardson, Joel Henry, A.B. (*Univ. of Oregon*) 1910, LL.B. (*Harvard Univ.*) 1913,	*La Grande, Ore.*	96 Prescott St.
Riddell, Earl Wilson, S.B. (*Pennsylvania State Coll.*) 1916,	*Bloomsburg, Pa.*	23 Mellen St.

Rightmire, Edwin, C.E. (*Ohio State Univ.*) 1914,	*Mt. Vernon, O.*	66 Kirkland St.
Ritchey, Herbert Dern, A.B. (*Princeton Univ.*) 1916,	*Altoona, Pa.*	4 Story St.
Robinson, Selwyn Aubrey, A.B. 1916,	*Makaweli Kanai, Hawaii,*	Hotel Somerset, Boston
Rogers, John Leonard, A.B. (*Boston Coll.*) 1915,	*Providence, R. I.*	120 Tockwotton St., [Providence, R. I.
Rosenberg, Louis, A.B. (*Univ. of Wisconsin*) 1916,	*Milwaukee, Wis.*	31 Everett St.
Russell, Donald May, S.B. (*Worcester Polytechnic Inst.*) 1913, E.E. (*ibid.*) 1916,	*Worcester,*	54 Garden St.
Seymour, Clinton Kirby, LL.B. (*Cornell Univ.*) 1916,	*Saginaw, Mich.*	356 Commonwealth Ave., Boston
Shaulis, Lloyd Lorenzo, A.B. 1915,	*Hollsopple, Pa.*	58 Sacramento St.
Sheets, Elmer Allen, Jr., LITT.B. (*Princeton Univ.*) 1916,	*Yonkers, N. Y.*	4 Story St.
Sherry, Alden Bradford, A.B. (*Cornell Univ.*) 1916,	*Troy, N. Y.*	33 Holyoke St.
Simmons, Richard James, A.B. (*Univ. of Michigan*) 1911, LL.B. (*ibid.*) 1913,	*Ann Arbor, Mich.*	Strathcona 504
Sippel, Edward Anthony, S.B. (*Northwestern Univ.*) 1916,	*Chicago, Ill.*	Ridgely 44
Small, Nathan Houston, A.B. (*Univ. of Maine*) 1913,	*Belfast, Me.*	44 Mt. Auburn St.
Smith, Paul Howard, S.B. (*Grinnell Coll.*) 1915,	*Grinnell, Ia.*	G. 34
Stacy, Edward Goodell, S.B. (*Colby Coll.*) 1911,	*Cambridge,*	19 Huron Ave.
Stoddard, James Leavitt, A.B. 1910, M.D. 1914,	*Northampton,*	226 Newbury St.
Sullivan, Henry Reed, S.B. (*Colgate Univ.*) 1914,	*Massena Springs, N. Y.*	11 Story St.
Surkamp, Arthur, A.B. (*Univ. of Texas*) 1913; LL.B. (*ibid.*) 1914,	*San Antonio, Tex.*	W. H. 53
Tarbill, Von Valjean, S.B. (*Ohio Wesleyan Univ.*) 1912,	*Delaware, O.*	18 Mellen St.
Teasdel, Harold Clyde, A.B. (*Univ. of Utah*) 1915,	*Salt Lake City, Utah,*	54 Dunster St.
Tharp, Victor, A.B. (*Grinnell Coll.*) 1915,	*Ottumwa, Ia.*	1582 Mass. Ave.

Van Brunt, John Harding, Jr., LL.B. (*Univ. of Chicago*) 1916,	*St. Joseph, Mo.*	Ridgely 64
Van Voris, John Minard, A.B. (*Wesleyan Univ., Conn.*) 1916,	*Cobleskill, N. Y.*	33 Holyoke St.
Wallace, John McChrystal, A.B. (*Univ. of Utah*) 1916,	*Salt Lake City, Utah,*	54 Dunster St.
Wardwell, Stanley Howard, A.B. 1916,	*Cleveland, O.*	Apley 32
Wei, Tingsheng Shenfu, A.B. 1916,	*Tang Hsien, Honan, China,*	P. 64
Whitney, Wilmot,*	*Newton,*	Dunster 42
Winner, Paul Chester, A.B. (*Lawrence Coll.*) 1914,	*Osseo, Wis.*	P. 55
Winsor, Edward Harrison, A.B. (*Brown Univ.*) 1915,	*Providence, R. I.*	12 Sumner R'd
Wolfe, Louis Ireton, A.B. (*Oberlin Coll.*) 1916,	*Cambridge,*	21 Ellsworth Ave.
Wood, Lester Gravatt, S.B. (*Hamline Univ.*) 1916,	*Rushmore, Minn.*	P. 55
Wooldredge, John, A.B. 1916,	*West Newton,*	Russell 22
Woolley, Vern Clark, S.B. (*Utah Agricultural Coll.*) 1911,	*Grantsville, Utah,*	P. 14
Yang, Chien, M.E. (*Cornell Univ.*) 1916,	*Hangchow, China,*	362 Harvard St.

Unclassified Students

Carret, Philip Lord,†	*Cambridge,*	S. 6
Conn, Warren Hatch,†	*Auburndale,*	1727 Cambridge St.
Cook, Roland Miller,†	*Worcester,*	Randolph 17
Flanagan, Edward Vincent,†	*Newton,*	Little 46
Jamieson, Arthur Ames,‡	*Poynette, Wis.*	Craigie 207
Leland, Frederic Talbot,†	*Holliston,*	M. 11
McDonald, Adrian James,†	*Ogdensburg, N. Y.*	T. 66
North, Cecil Junior,†	*Trenton, N. J.*	S. 28
Sargent, John Albert,†	*Westminster,*	79 Magazine St.

* Has completed work in Harvard College for the Bachelor's degree.

† Lacking not more than one full course for A.B. degree in Harvard College.

‡ Lacks thesis required for degree in Wisconsin University.

Special Students

Adams, Frank Woods,	*Boston,*	50 Charlesgate East, Boston
Andrews, George Angell, Gr., *U. S. Naval Academy,* 1913,	*Grand Haven, Mich.*	11 Stone R'd, Belmont
Bernheimer, Clement Mayer,	*Newburyport,*	70 Kilby St., Boston
Blanchard, Charles Barnes, A.B. 1914,	*Brookline,*	Harvard University Press
Chase, Burr Linden, A.B. 1913,	*Niagara Falls, N. Y.*	381 Harvard St.
Cone, Morris Huntington, A.B. (*Dartmouth Coll.*) 1913,	*Hartford, Vt.*	84 Prescott St.
Copeland, Walter Emerson,	*Brockton,*	793 No. Main St., Brockton
Crane, Russell Day, A.B. 1900	*Cambridge,*	698 Mass. Ave.
Crisp, Frederick Graften, Gr., *U. S. Naval Academy,* 1913,	*Cambridge,*	10 Dana St.
Davis, Theodore Lawrence, B.B.A. (*Boston Univ.*) 1915,	*Manchester, N. H.*	182 Elm St.
Durkin, Joseph Leonard,	*Spokane, Wash.*	3 Concord Ave.
Enright, Earl Francis, Gr. *U. S. Naval Academy,* 1913,	*McCook, Neb.*	7 Centre St.
Faden, Andrew Franklin, A.B. 1905,	*Swampscott,*	200 Devonshire St., Boston
Gayhart, Everett LeRoy, Gr., *U. S. Naval Academy,* 1913,	*Toledo, O.*	10 Dana St.
Hamilton, James Scott,	*Allston,*	16 Farrington Ave., Allston
Harding, Frank Cushman,	*Needham,*	High Rock St., Needham
Heald, Frank Albert,	*Watertown,*	27 Franklin St., Watertown
Hedderich, August, *Zeugnis der Reife of Grossh., Neuer Gymn. zu Darmstadt,*	*Brookline,*	21 Gibbs St., B'kline
Hills, Harold Wedderburn,	*Lowell,*	4 Avon St.
Hosmer, Joseph Blaine,	*Winthrop,*	358 Harvard St.
Keith, William Jackson,	*Newton,*	527 Washington St., Newton
Lane, Andrew Patrick,	*Dorchester,*	49 Sargent St., Dor.
Meyer, Alfred Reuben, A.B. 1910,	*Belmont,*	504 Concord Ave., Belmont
Oita, Torao, LL.B. (*Law College of Tokyo Imperial Univ.*) 1909,	*Tokyo, Japan,*	50 St. Paul St., B'kline
Pottinger, David Thomas, A.B. 1906, A.M. 1914,	*Cambridge,*	44 Martin St.
Prince, Morton Peabody, A.B. 1910,	*Boston,*	458 Beacon St., Boston
Robinson, Lansing Roberts,	*Allston,*	55 Ashford St., Allston
Sanders, Martin Franklin,	*Provo, Utah,*	885 Mass. Ave.

Searles, Thomas Mount, S.B. (*Miss. A. and M. Coll.*) 1909, Gr., *U. S. Naval Academy*, 1913,	*Allston,*	1384 Commonwealth Ave., Allston
Sortwell, Alvin Foye, A.B. 1914,	*Hamilton,*	15 State St., Boston
Sugmioto, Yoshiro, LL.B. (*Tokio Imperial University*) 1907,	*Shidznoka City, Japan,*	50 St. Paul St., B'kline
Takahashi, Gentaro,	*Gumma-ken, Japan,*	8 Druce St., B'kline
Thomas, Royal Vearl, LL.B. (*Georgetown Univ.*) 1915	*McSouth, Kan.*	3 Hubbard P'k.
Thompson, Norman Robinson,	*Newton Centre,*	48 Braeland Ave., Newton Centre
Tiffany, Charles Howard,	*Boston,*	6 Ashburton Pl., Boston
Wheeler, Frank Walker, A.B. 1916,	*Rockville Centre, N.Y.*	2 Prescott St.
Wong, Samuel So, S.B. (*St. Lawrence Univ.*) 1916,	*Honolulu, Hawaii,*	8½ Ash St. Pl.
Yeh, Chien Peh, S.B. in E.E. (*Purdue Univ.*) 1916,	*Shantung, China,*	14 Oxford St.
Zeigler, Samuel Jacob, Jr., Gr., *U. S. Naval Academy*, 1912,	*Shreveport, La.*	10 Avon St.

Graduates in 1916

ON COMMENCEMENT DAY, JUNE 22, 1916, DEGREES WERE CONFERED AS FOLLOWS:

Lawrence Burke Anderson, A.B. (*Kansas State Normal Coll.*) 1912.
Howard Clyde Baldwin, S.B. (*Pennsylvania State Coll.*) 1914.
Frederick Earl Bates, A.B. (*Lake Forest Coll.*) 1914.
Glenn Alwyn Bowers, A.B. (*Colorado Coll.*) 1913.
Thomas Rush Brown, A.B. (*Arkansas Coll.*) 1914.
Emory Moran Canright, S.B. (*Beloit Coll.*) 1914.
Loy Chang, A.B. 1913.
Alvin Rudolph Dallmeyer, A.B. (*Westminster Coll.*) 1914.
Robert Tenney Davis, A.B. 1914.
Thomas Aloysius Dowd, A.B. (*Holy Cross Coll.*) 1914.
Hardy Haughran Gordon, A.B. (*Clark Coll.*) 1914.
Arthur Stanley Harris, A.B. 1914.
Raymond Head Hatch, S.B. (*Colgate Coll.*) 1914.
Edward John Hickey, Jr., A.B. (*Univ. of Detroit*) 1914.
Edward Deane Hunton, S.B. (*Univ. of Wyoming*) 1911.
John Woddick Kapples, A.B. (*Boston Coll.*) 1914.
George Washington Kassler, LITT.B. (*Princeton Univ.*) 1914.
Homer Melvin Lackey, A.B. (*Univ. of Oregon*) 1910.
Walter Elroy Lundquist, S.B. (*Knox Coll.*) 1913.
Gleed Miller, A.B. (*Univ. of Michigan*) 1914.
James Bernard Miller, A.B. 1914.
Wells Boynton Miller, A.B. 1914.
Thomas Courtney O'Hare, A.B. (*Boston Coll.*) 1914.
Arthur Heath Onthank, A.B. 1914.
Erle Ewart Peacock, A.B. (*Univ. of Georgia*) 1914.
Summerfield Griffith Roberts, A.B. (*Univ. of Texas*) 1914.
Grundy Lewis Shapard, S.B. (*Polytechnic Coll.*) 1913.
Ih Hsuan Si, A.B. (*Univ. of Michigan*) 1913.
John Jopson Spearman, S.B. (*Grove City Coll.*) 1914.
Myles Standish, Jr., A.B. (*Bowdoin Coll.*) 1914.
Don Lorenzo Stevens, S.B. (*Case School of Applied Science*) 1914.
Norman Taylor Thomas, A.B. (*Boston Univ.*) 1914.
Frank Spalding Welsh, A.B. 1915.
Charles Ernest Young, PH.B. (*Bucknell Coll.*) 1910.

With Distinction

Henry Hallowell Farquhar, A.B. (*Univ. of Michigan*) 1915.
Warren Jay Keyes, A.B. (*Yale Univ.*) 1914.
William Allen Sleeper, A.B. (*Amherst Coll.*) 1909.

The Following were Awarded the May Prizes for 1916

Hardy Haughran Gordon, first prize.
Warren Jay Keyes, second prize.

Statistics

Enrolment 1908–16 Inclusive

Year	Students Doing Full Work 1st yr.	2d yr.	Specials	Total Enrol-ment	States Repre-sented	Foreign Coun-tries	Colleges Repre-sented
1908–09	33		47	80	12	3	14
1909–10	42	8	41	91	16	5	19
1910–11	43	10	41	94	20	2	22
1911–12	55	10	32	97	21	4	25
1912–13	77	11	32	120	26	4	42
1913–14	67	32	18	117	28	3	47
1914–15	108	27	31	166	36	4	64
1915–16	117	40	33	190	36	5	71

Registration 1916–17

Graduate Student	1
Second-year Students	50
First-year Students	133
Unclassified Students	9
Special Students	39
TOTAL	232

Distribution by States 1916–17

Alabama	1
Arkansas	2
California	11
Colorado	1
Connecticut	3
Florida	1
Illinois	6
Indiana	8
Iowa	4
Kansas	4
Louisiana	1
Maine	6
Massachusetts	68
Michigan	4
Minnesota	3
Missouri	3
Nebraska	1
North Carolina	2
New Hampshire	3
New Jersey	3
New York	15
Ohio	17
Oklahoma	1
Oregon	4
Pennsylvania	12
Rhode Island	3
South Carolina	1
Tennessee	1
Texas	3
Utah	5
Vermont	3
Washington	2
West Virginia	2
Wisconsin	8
Territory of Hawaii	2

FOREIGN COUNTRIES

China	7
Japan	4
Canada	2

Distribution by Colleges, 1916–17

Acadia University	1
Amherst College	3
Arkansas College	2
Bates College	1
Beloit College	1
Boston College	4
Boston University	3
Bowdoin College	3
Brown University	2
Carleton College	1
Carnegie Institute of Technology	1
Carthage College	1
Case School of Applied Science	1
Catholic University, Washington, D. C.	1
Clark College	1
Colby College	2
Colgate University	1
Cornell University	3
Dartmouth College	3
DePauw University	1
Fordham University	1
Georgetown University	1
Grinnell College	2
Hamilton College	2
Hamline College	1
Harvard University	57
Holy Cross College	4
Iowa State University	1
Kansas State College	1
Keiogijiku University	1
Lawrence College	1
Lebanon Valley College	2
Leland Standord, Jr. University	5
Massachusetts Agricultural College	1
Massachusetts Institute of Technology	1
Miami University	2
Mississippi Agricultural and Mechanical College	1
Newton Theological Institute	1
New York University	1
Northwestern University	2
Oberlin College	2
Occidental College	1
Ohio State University	3
Ohio Wesleyan University	3
Olivet College	1
Otterbein University	1
Park College	1
Pennsylvania State College	2
Pomona College	4
Princeton University	10
Purdue University	2
Ripon College	1
St John's University, China	2
St John's University, Ohio	1
St. Lawrence University	1
Syracuse University	2
Tokio University	2
Trinity College	2
United States Naval Academy	6
University of Alabama	1
University of California	3
University of Chicago	1
University of Colorado	1
University of Illinois	1
University of Indiana	1
University of Kansas	1
University of Maine	2
University of Michigan	2
University of Oregon	3
University of Pennsylvania	4
University of Texas	3
University of Utah	2
University of West Virginia	1
University of Wisconsin	5
Utah Agricultural College	1
Wabash College	3
Washburn College	2
Washington and Jefferson College	2
Wesleyan University, Conn.	2
West Virginia Wesleyan College	1
Williams College	3
Wofford College	1
Worcester Polytechnic College	3
Yale University	3
	—
Total	223
Total number College Graduates	213
Total number of Colleges represented	84
Counted more than once	8

OFFICIAL REGISTER OF HARVARD UNIVERSITY

[*Entered March 6, 1913, at Boston, Mass., as second-class matter, under Act of Congress of August 24, 1912.*]

Issued at Cambridge Station, Boston, Mass., three times each, in January, February, July, August, and September; eight times each, in March, April, May, and June; twice each, in October, November, and December.

These publications include: —

The Annual Reports of the President and of the Treasurer.
The Annual University Catalogue.
The Annual Catalogues of the College and the several Professional Schools of the University; the Descriptive Pamphlet; the Announcements of the several Departments; etc., etc.

Inquiries concerning the Graduate School of Business Administration should be addressed to the Dean of the Graduate School of Business Administration, No. 17 University Hall, Cambridge, Mass.

Pamphlets
Massachusetts
v.9

SD144
M3P3
v.9

406652

UNIVERSITY OF CALIFORNIA LIBRARY